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A Framework for Explaining Accounting Students' Formal Communication GAP

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Does Highly Concentrated Market Inevitably Lead to Predatory Pricing? The Case of the Mexican Banking Industry

Chu V. Nguyen

Charles Smith*

Justo Manrique

Abstract

Asymmetries in the Mexican lending-deposit rate spread were documented. Empirical results revealed that the lending-deposit rate spread adjusts to the threshold faster when the deposit rates fall relative to the lending rates than when the deposit rates move in the opposite direction. This non-predatory rate setting behavior in the highly concentrated market may be attributable to the rise in foreign bank entry, which has fostered market contestability over the sample period. The empirical results also revealed the bidirectional Granger causality between the lending rate and the deposit rate, indicating that the lending rate and the deposit rate affect each other's movement.

Key Words: Asymmetry; lending rate; deposit rate; lending-deposit rate spread; Mexican predatory pricing behavior.

JEL classification codes: C22; E44; G21.

Introduction

The financial sector in general and commercial banks in particular play a significant role in promoting the industrialization and economic development of a country and are well documented in financial economics literature. This sector is expected to provide efficient intermediation to mobilize savings and channel them into productive investments and thus promote industrialization and development. Additionally, the banking sector is an integral part of the monetary policy transmission mechanism. These intermediaries would derive their interest income from the spread between the lending rate charged to borrowers and the deposit rate paid to savers. Economic theory has articulated that if the lending rates or spread is high, it would reflect inefficiency and/or lack of competition, and keep the financial sector from fulfilling its expected role in the economic development process. Furthermore, commercial banks' behavior in setting their deposit and lending rates significantly influences the effectiveness of the monetary authority in its monetary policymaking.¹

As suggested by Thompson (2006), banks may set their lending rates as some markup or premium over their deposit rates. If the premium is perceived to be too high or too low, the market forces will discipline banks to adjust back to some equilibrium spread. More importantly, part of any market determined lending rate, and hence lending-deposit rate spread, is risk premium. Therefore, despite conventional microeconomic theoretical articulation otherwise, operating in a highly concentrated market, charging high nominal lending rates or lending-deposit rate spread, and asymmetrically pricing financial products are necessary, but not sufficient, evidence of exhibiting oligopolistic/monopolistic market power by financial institutions in the context of predatory pricing. A highly concentrated market, high lending rate or lending-deposit rate spread, coupled with the predatory asymmetric rate-setting ability are stronger evidence of market power.

The evidence of asymmetric rate-setting behavior in the banking industry supports the literature hypothesizing the asymmetric effects of monetary policy on output. There are three main theoretical explanations for commercial bank interest rate asymmetries: bank

concentration hypothesis, consumer characteristic hypothesis, and consumer reaction hypothesis.²

The bank concentration hypothesis posits that banks in more concentrated markets are slower to adjust deposit rates upward and faster to adjust them downward while exhibiting the opposite behavior regarding lending rates (Neumark and Sharpe, 1992; Hannan and Berger, 1991). The consumer characteristic hypothesis asserts that the greater the proportion of unsophisticated consumers relative to sophisticated consumers in the market, together with the potential search and switching costs, the greater the banks' ability to adjust interest rates to their advantage (Calem and Mester, 1995; Hutchison, 1995; Rosen, 2002).

However, the asymmetric adjustment in lending rates may actually benefit the consumers. As articulated by Stiglitz and Weiss (1981), the presence of asymmetric information may create an adverse selection problem in lending markets such that higher interest rates will tend to attract riskier borrowers. Therefore, banks would be reluctant to raise lending rates, even if market rates rise. The expected cost to the banks of not raising the lending rates when their marginal cost of fund increases, will be offset by the benefits from not encouraging the higher-risk consumers to borrow.

Additionally, the asymmetric rate-setting in the context of rates of return on financial market instruments in developed economies has been empirically documented in financial economics literature. Arak et al. (1983), Goldberg (1984), Forbes and Mayne (1989), Levine and Loeb (1989), Mester and Saunders (1995), Dueker (2000), and Tkacz (2001) have reported asymmetries in the U.S. prime lending rate in the past. Thompson (2006) found asymmetries in the U.S. prime lending-deposit rate spread. Cook and Hahn (1989), Moazzami (1999), and Sarno and Thornton (2003) found asymmetries in U.S. Treasury

securities in their studies. Frost and Bowden (1999) and Scholnick (1999) reported asymmetries in mortgage rates in New Zealand, and Canada. Heffernan (1997) and Hofmann and Mizen (2004) indicated asymmetric behavior of retail rates in the United Kingdom. Hannan and Berger (1991), Neumark and Sharpe (1992), and Diebold and Sharpe (1990) examine various deposit rates for the same behavior.

The Mexican Financial Sector

The Mexican economy has experienced some adverse financial phenomena in the recent history: the debt overhang in the 1980s, the Tequila attack in the early 1990s, and most recently the contagion of the U.S. subprime mortgage crisis. The banking system was nationalized and privatized to complete the circle to the current state of the system of an emerging economy.³ The central bank of Mexico (Banco de México) regulates the money supply and foreign exchange markets, sets reserve requirements for Mexican banks, and enforces credit controls. It serves as the fiscal agent of the federal government, the issuing bank for the peso, and as a discount house for private deposit banks. It supervises the private banking sector through the National Banking Commission.

As pointed out in the IMF Country Report (no 01/192, October 2001, p. 9), Mexico, up to the early 1990s, had most of the financial institutions found in the financial systems of industrial countries, but the degree of development across sectors varied significantly. The banking sector dominated the financial system. Large conglomerates headed by banks normally provided private financial services. State-owned banks were involved in development-related lending, and housing finance. Nonbanking institutions included finance and factoring companies, specialized investment funds, pension funds, and insurance companies (IMF Country Report no 01/192, October 2001, p. 10).

In regard to the banking system, Blavy and Souto (2009, p. 7) characterized the Mexican banking system as having a low level of financial intermediation, with bank credit to the private sector substantially lower than in comparator countries. Moreover, the authors observed that an important share of banks' assets was devoted to holdings of public sector debt instruments. However, the banking sector consumer- and mortgage-lending increased significantly, starting in early 2000. For example, from 2002 to 2007, consumer-lending increasing on average increased by over 40 percent each year from 2002 to 2007 (Blavy and Souto 2009, p. 7). More recently, consumer-lending has slowed greatly, while credit to firms picked up in the last two years. Following the currency crisis of late 1994, known as the Tequila attack, the government was forced to raise interest rates sharply in order to protect the peso's value by retaining existing short-term foreign investment and attracting new capital inflows. High interest rates during 1995 sharply increased the payments owed by Mexican individual and business borrowers, many of whom could not shoulder the increased burden. As a result, the share of nonperforming to performing loans held by Mexican banks rose significantly, creating a major crisis for the financial sector. As pointed out by Zanforlin and Espinosa (2008, p. 5) the sharp interest rate spike in the aftermath of the Tequila crisis triggered a wave of bank mortgage defaults. The majority of mortgage lending in the early 1990s had adjustable interest rates. After the crisis, commercial banks relinquished almost entirely the origination of real estate mortgages to nonbank financial institutions and public sector entities. In 1994 nonbank financial intermediaries that specialized in real estate mortgages (Sofoles) were created, with their core market consisting of low-income households. Additionally, as pointed out in IMF Country Report (no 01/192, October 2001, p. 12),

another consequence of the Tequila attack is a contractionary trend in the banking industry. After the crisis, banking system assets shrank from 55 percent of GDP at the end of 1994 to 37 percent of GDP at the end of 2000. Even more spectacular was the contraction of bank credit to the private sector—it represented 76 percent of bank assets (43 percent of GDP) at the end of 1994, and shrank to the equivalent of 22 percent of bank asset (10 percent of GDP) at the end of 2000.

In the face of the Tequila crisis and its attendant economic and financial difficulties, the Mexican economy underwent a significant transformation to comply with the North American Free Trade Agreement (NAFTA), implemented in January 1994 and one year later -- to the day -- with the World Trade Organization (WTO) agreement. Complying with the NAFTA and WTO is an important undertaking for developing nations. NAFTA and WTO memberships, without a doubt, change the characteristics and the complexity of the Mexican economy. Tariffs in all sectors are decreased substantially over time. Being a member of NAFTA and WTO also entails a wide array of commitments from Mexico to reduce trade-distorting subsidies, establish foreign companies' trading rights, and comply with the full range of NAFTA and WTO rules and regulations. The distribution sector has to be opened up from the date of accession to foreign companies engaging in joint ventures with domestic partners that are allowed to operate in all but a few specific sectors or activities.

In regard to engagement of foreign banks in Mexico, Blavy and Souto (2009, p. 7) reported that the banking sector is highly concentrated, and dominated by foreign-owned banks. To substantiate their position, these authors cited that BBVA Bancomer, Banco Mercantil del Norte, Banco Nacional de México, Banco Santander, HSBC and Scotiabank Inverlat are the six largest banks in Mexico. Five of them are foreign owned. More striking, (IMF

Country Report no 01/192, October 2001, p. 13), has been the rise in foreign participation in the Mexican banking system, as the share in total assets of foreign-controlled banks rose from 24 percent in 1998 to nearly 50 percent at the end of 2000, and will reach over 70 percent when the purchase of Banamex by Citigroup is completed.

Thus, across this spectrum of events, it can be arguably posited that, over the NAFTA and WTO membership era, Mexican banks have been operating in fairly concentrated markets. The most important question is: does highly concentrated market inevitably lead to predatory pricing behavior as oligopolistic/monopolistic economic theory suggested? More specifically, do asymmetries exist in the Mexican lending-deposit rate spread, and if so, do such asymmetries reveal that the Mexican banks engage in

oligopolistic/monopolistic or competitive rate-setting behavior? Second, if asymmetries are present, how do lending and deposit rates respond to such asymmetries? The remainder of this study is organized as follows: the next section describes the data used in this study and its descriptive statistics; the following section briefly describes the methodology used in the investigation; the section that follows reports the empirical results; and the final section provides concluding remarks.

Data

To study the market power of Mexican banks in the NAFTA and WTO membership era by investigating the asymmetries in the Mexican lending-deposit rate spread, this analysis utilizes monthly data from International Financial Statistics, published by the IMF, over the period of 1995:02 to 2010:01.

Mexican Lending Rates and Deposit Rates

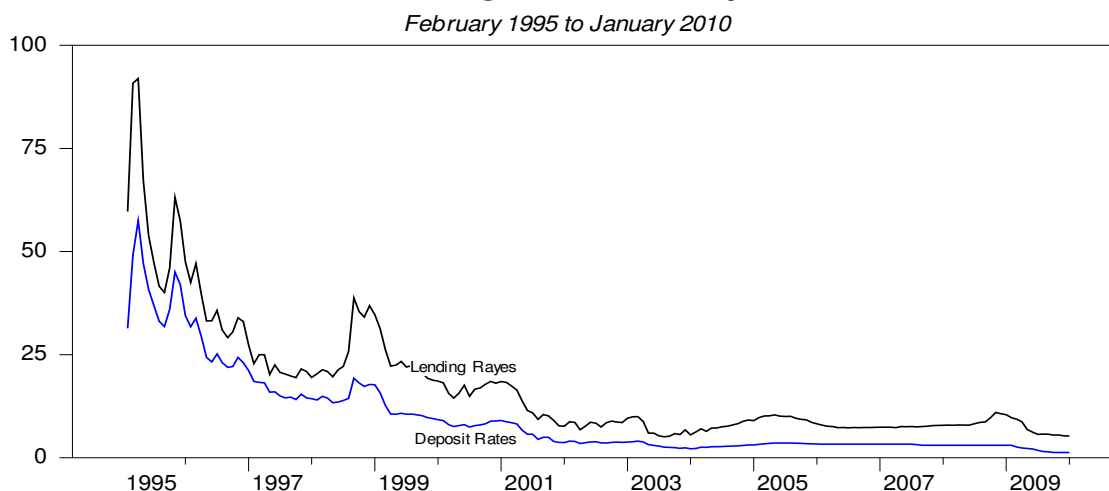


Figure 1

Figure 1 displays the behavior of the respective lending and deposit rates over the sample period (correlation = 0.975). The mean lending rate during this period is 17.13 percent, and ranges from 5.15 to 91.97. The mean deposit rate over the same period is 9.77 percent, and ranges from 1.30 to 57.51. These descriptive statistics indicate that the lending rates are high relative to deposit rates and the

resulting spreads were very high by international standards, raising questions as to whether the risk premium or the oligopolistic/monopolistic power led to this phenomenon in the NAFTA and WTO era in Mexico.

Methodology

As aforementioned, the Mexican economy and its financial sector have gone through many

changes and experienced many economic shocks; therefore, it is possible that the lending rates and the deposit rates might experience structural breaks over the sample period. To avoid possible misspecification of equation (1) due to failure to account for structural shifts and hence the entire model, following Perron (1997) procedure, this study specified and estimated an endogenous unit root test function with the intercept, slope, and the trend dummies to test the hypothesis that the Mexican lending rates and the deposit rates have experienced structural shifts over the sample period. The estimation results of these tests suggest that both the Mexican lending rates and the deposit rates might experience structural breaks in March 2001, possibly due to the impact of the recession in the US—its Northern neighbor and major trading partner. However, the test statistics rejected this suggested possibility at any conventional level of significance (see the Appendix).

Given the result of the structural break tests and to investigate the aforementioned concern, the threshold autoregressive (TAR) model developed by Enders and Siklos (2001) is estimated to formally examine the behavior of the Mexican lending-deposit rate spread. The threshold autoregressive model allows the degree of autoregressive decay to depend on the state of the lending-deposit rate spread, (i.e., “deepness” of cycles). The estimated

$$LR_t = \beta_0 + \beta_1 DR_t + \beta_2 Dummy_t + \beta_3 Trend_t + \varepsilon_t \quad (1)$$

where LR_t and DR_t are denoted as the lending rate and the deposit rate, respectively. $Trend_t$ is a time trend and $Dummy_t$ is a dummy (with values of zero prior to March 2001 and values of one for March 2001 and thereafter). The

$$\Delta \hat{\varepsilon}_t = I_t \rho_1 \hat{\varepsilon}_{t-1} + (1 - I_t) \rho_2 \hat{\varepsilon}_{t-1} + \sum_{i=1}^p \alpha_i \Delta \hat{\varepsilon}_{t-i} + \hat{u}_t \quad (2)$$

where $\hat{u}_t \sim i.i.d.(0, \sigma^2)$, and the lagged values of $\Delta \hat{\varepsilon}_t$ are meant to yield uncorrelated residuals. As defined by Enders and Granger

TAR model empirically reveals whether the spread tends to revert to the long-run position faster when the spread is above or below the threshold. Therefore, the estimated TAR model indicates whether troughs or peaks persist more when shocks push the spread out of its long term path. For instance, if the autoregressive decay is fast when the spread is above the trend and slow when the spread is below the trend, troughs will be more persistent than peaks. Likewise, if the autoregressive decay is slow when the spread is above trend and fast when the spread is below trend, peaks will be more persistent than troughs. In this model's specification, the null hypothesis that the lending-deposit rate spread contains a unit root can be expressed as $\rho_1 = \rho_2 = 0$, while the hypothesis that the spread is stationary with symmetric adjustments can be stated as $\rho_1 = \rho_2$.

Enders and Siklos (2001) extended the popular two-step symmetric Engle-Granger (1987) methodology to test for long-run relationships between two time series allowing for asymmetry. As demonstrated by Enders-Siklos (2001), the first step in the procedure is to follow the Engle-Granger (1987) methodology to estimate the following long-run relationship between the Mexican lending rate and deposit rate using ordinary least squares.

saved residuals, ε_t from the estimation of equation (1), denoted by $\hat{\varepsilon}_t$, are then used to estimate the following TAR model:

(1998), the Heaviside indicator function for the model is given as:

$$I_t = \begin{cases} 1 & \text{if } \hat{\varepsilon}_{t-1} \geq \tau \\ 0 & \text{if } \hat{\varepsilon}_{t-1} < \tau \end{cases} \quad (3)$$

The threshold value, τ , is endogenously determined using the Chan (1993) procedure, which obtains τ by minimizing the sum of squared residuals after sorting the estimated residuals in ascending order, and eliminating 15 percent of the largest and smallest values. The elimination of the largest and smallest values is to assure that the $\hat{\varepsilon}_t$ series crosses through the threshold in the sample period.

Empirical Results

The estimation results of the model are summarized in Table 1. An analysis of the overall empirical results indicates that the estimation results are devoid of serial correlation and have good predicting power, as evidenced by the Ljung-Box statistics and the overall F-statistics, respectively. With the calculated statistic $\Phi_\mu = 66.5866$, the null hypothesis of a unit root ($\rho_1 = \rho_2 = 0$) is rejected at the 1 percent significance level

Table 1: Unit Root and Tests of Asymmetry, Mexican Monthly Data, 1995:02 to 2010:01

ρ_1	ρ_2	τ	$H_0 : \rho_1 = \rho_2 = 0$	$H_0 : \rho_1 = \rho_2$	aic
-0.6292*	-0.1132*	1.7837	$\Phi_\mu = 66.5866^*$	$F = 51.3378^*$	0.0404
$Q_{LB(2)} = 4.0920[0.1292]$			$\ln L = -267.9745$	$F_{(4,173)} = 41.1168^*$	

Notes: The null hypothesis of a unit root, $H_0 : \rho_1 = \rho_2 = 0$, uses the critical values from Enders and Siklos (2001, p. 170, Table 1, for four lagged changes and $n = 100$). "*" and "***" indicate 1 and 5 percent levels of significance. The null hypothesis of symmetry, $H_0 : \rho_1 = \rho_2$, uses the standard F distribution. τ is the threshold value determined via the Chan (1993) method. $Q_{LB(2)}$ denotes the Ljung-Box Q-statistic with 2 lags.

With regard to the adjustment process, given $|\rho_1| > |\rho_2|$, the Mexican lending-deposit rate spread adjusts to the threshold value faster when monetary policy action or economic shock causes the deposit rates to fall relative to the lending rates, widening the spread, than when the deposit rates move in the opposite direction, narrowing the spread. These findings contradict those reported by

(i.e., the spread is stationary). As to the speed of adjustment, based on the partial test statistic $F = 51.3378$, the null hypothesis of symmetry, $\rho_1 = \rho_2$, is rejected at any conventional significance level. Thus, the empirical results indicate that adjustments around the threshold value of the Mexican lending-deposit rate spread are asymmetric. In fact, the point estimates suggest that the spread tends to decay at the rate of $|\rho_1| = 0.6292$ for $\hat{\varepsilon}_{t-1}$ above the threshold, $\tau = 1.7837$, and at the rate of $|\rho_2| = 0.1132$ for $\hat{\varepsilon}_{t-1}$ below the threshold. Both ρ_1 and ρ_2 are statistically significant at 1 percent level. Furthermore, the estimates of ρ_1 and ρ_2 satisfy the stationary (convergence) conditions.⁴ With regard to the stationarity of the basis, Ewing et al. (2006, p. 14) pointed out that this simple finding is consistent with the two underlying series that comprise the basis being co-integrated in the conventional, linear combination sense.

Thompson (2006) in the U.S. with respect to the prime rate and the secondary market one-month CD rate, and seem to support the position articulated by the consumer-reaction hypothesis articulated by Stiglitz and Weiss (1981), that the presence of asymmetric information may create an adverse selection problem in lending markets such that higher interest rates will tend to attract riskier borrowers. These empirical findings seem to

suggest strongly that the observed high lending rate and deposit-lending rate spread be attributable to the risk profile of the Mexican economy.

More interestingly, these empirical findings parallel the standard econometric simulation results conducted by the IMF's Financial Sector Assessment Program (FSAP) mission that supports the hypothesis that "observed interest rates and loan quantities have been statistically equivalent to those a competitive system would have produced." This suggests that the larger players have not exhibited predatory pricing behavior. The lack of evidence on predatory pricing behavior in spite of the increased concentration, over the

$$\Delta LR_t = \alpha_0 + \rho_1 I_t \hat{\varepsilon}_{t-1} + \rho_2 (1 - I_t) \hat{\varepsilon}_{t-1} + A_{11}(L) \Delta LR_{t-i} + A_{12}(L) \Delta DR_{t-i} + u_{1t} \quad (4)$$

$$\Delta DR_t = \tilde{\alpha}_0 + \tilde{\rho}_1 I_t \hat{\varepsilon}_{t-1} + \tilde{\rho}_2 (1 - I_t) \hat{\varepsilon}_{t-1} + A_{21}(L) \Delta LR_{t-i} + A_{22}(L) \Delta DR_{t-i} + u_{2t} \quad (5)$$

where $u_{1,2t} \sim i.i.d.(0, \sigma^2)$ and I_t is set in accordance with equation (3).

As pointed out by Thompson (2006, pp. 327-328), the above specified TAR VEC model differs from the conventional error-correction models by allowing asymmetric adjustments toward the long-run equilibrium. Also, the asymmetric error correctional model replaces the single symmetric error correction term with two error correction terms. Thus, in addition to estimating the long-run equilibrium relationship and asymmetric adjustment, the model also allows for tests of short-run dynamic between changes in lending rate and deposit rate. This in turn reveals the nature of their Granger causality.

The estimation results of the asymmetric error correction model are reported in Table 2. In the summary of the estimation results, $A_{ij}(L)$ represents the first-order polynomials in the lag operator L . The F_{ij} represents the calculated partial F-statistics with the p-value in squared brackets testing the null hypothesis that all coefficients of A_{ij} are equal to zero. The t-statistics are reported with "*" and "**"

NAFTA and WTO membership era, is likely explained by the rise in foreign bank entry, which has fostered market contestability (IMF Country Report no 01/192, October 2001, p. 33).

Results of the Asymmetric Error-Correction Model

The presence of asymmetric adjustments in the Mexican lending-deposit rate spread, as indicated by the above estimation results, necessitates the estimation of a TAR VEC model to further investigate the short-run and long-run dynamics with respect to the lending rate (LR_t) and the deposit rate (DR_t).

indicating the 1 and 5 percent significant levels, respectively. $Q_{LB(2)}$ is the Ljung-Box statistics and its significance is in squared brackets, testing for the first six of the residual autocorrelations to be jointly equal to zero. In L is the log likelihood. The overall F-statistic with "*" indicates the significance level of 1 percent.

An analysis of the overall empirical results indicates that the estimated equations (4) and (5) are devoid of serial correlation and have good predicting power as evidenced by the Ljung-Box statistics and the overall F-statistics, respectively. As to the short-run dynamic adjustment, the calculated partial F-statistics in equations (4) and (5) indicate bidirectional Granger-causality between Mexican lending and deposit rates. These results imply that the Mexican lending rate and deposit rate adjustments affected each other's movements, which parallel those reported by Thompson with respect to the prime lending rate and the one-month CD rate in the U.S. banking industry, i.e., there is evidence of Granger bidirectional causality.

Table 2: Asymmetric Error Correction Model, Mexican Monthly Data, 1995:02 to 2010:01

$$\Delta LR_{it} = 0.0568 - 0.3324I_t\hat{\varepsilon}_{t-1} + 0.0286(1 - I_t)\hat{\varepsilon}_{t-1} + A_{21}(L)\Delta LR_{it-i} + A_{22}(L)\Delta DR_{it-i} + u_{1t}$$

0.3759 -3.8237* 0.3246 $F_{11}=13.9307[0.000]$ $F_{21}=17.5226[0.000]$

$$Q_{LB(2)} = 0.9000[0.6377] \quad \ln L = -319.5516 \quad F_{(6,160)} = 9.3290^*$$

$$\Delta DR_{it} = -0.1233 - 0.1214I_t\hat{\varepsilon}_{t-1} + 0.0634(1 - I_t)\hat{\varepsilon}_{t-1} + A_{21}(L)\Delta LR_{it-i} + A_{22}(L)\Delta DR_{it-i} + u_{2t}$$

-1.3153 -2.2679 ** 1.2917 $F_{21}= 27.4639[0.000]$ $F_{22}=32.5082[0.002]$

$$Q_{LB(2)} = 5.4230[0.0665] \quad \ln L = -248.6013 \quad F_{(7,159)} = 19.5433^*$$

In addition to revealing the short-run dynamic Granger-causality, the asymmetric error correction model also allows the long-run adjustments of the lending rate, $|\rho_1| > |\rho_2|$ in equation (4), indicating that the lending rate adjusts to the long-run equilibrium faster when the shock widens than when it narrows the lending-deposit rate spread. This empirical finding is consistent with the estimation results of the TAR model. However, while ρ_1 is statistically significant at 1 percent, ρ_2 is not significant at any conventional level. Economically, this result suggests that the Mexican lending rate does not respond to contractionary monetary policy in the long run. With regard to the long-run adjustment of the deposit rate, the estimation results for equation (5) show that $|\tilde{\rho}_1| > |\tilde{\rho}_2|$, and only $\tilde{\rho}_1$ is statistically significant at 5 percent level. These findings suggest that the deposit rate only responds to the expansionary monetary policy, widening the lending-deposit rate spread, but does not respond to contractionary monetary policy that narrows the spread in the long run.

Concluding Remarks

This study utilized the threshold autoregressive (TAR) model developed by Enders and Siklos (2001) to examine the Mexican banks' lending-deposit rates setting behavior. Contrary to conventional wisdom, the empirical results suggest that Mexican

banks do not engage in predatory pricing strategy that is expected in the concentrated markets. In fact the Mexican lending rate-deposit rate spread adjusts faster toward the threshold value when the spread is widening (i.e., decreasing the deposit rate) than when the spread is narrowing (i.e., increasing the deposit rate). These findings contradict those reported by Thompson (2006) regarding the responses of the U.S. prime lending rate and the one-month CD rate to their spread, but seem to support the consumer reaction hypothesis articulated by Stiglitz and Weiss (1981).

With regard to the short-run and long-run dynamics of the Mexican lending and deposit rates, the empirical estimations of the asymmetric error-correction model reveal that the lending rate and the deposit rate affect each other's movement. These bidirectional Granger causality findings parallel those reported by Thompson (2006) with respect to the prime lending rate and the one-month CD rate. The estimation results further suggest that the lending rate adjusts to the long-run equilibrium faster when a shock widens than when it narrows the lending-deposit rate spread. However, the estimation results seem to indicate that the deposit rate only responds when the spread is widening, not when it is narrowing in the long-run.

These empirical findings are important because they indicate that Mexican contractionary and expansionary monetary

policy actions affect the market rates differently. The banking system, operating in a fairly highly concentrated market where five out of the six largest banks are foreign owned, is quite wary of high-risk borrowers, and avoids the high-return and high-risk pricing strategy. Thus, the high lending rates and the high market rate spreads are attributable to the high-risk profile of the economy. The lack of evidence on predatory pricing behavior in spite of the increased market concentration is likely explained by the rise in foreign bank entry, which has fostered market contestability,

Endnotes

¹ Sellon (2002) provides a nice overview of the impact of the changing U.S. financial system on the interest rate channel for monetary policy transmission.

² Scholnick (1999) provides the survey on these three types of explanations for

commercial banks' interest rate asymmetries in the literature.

³ Mexican commercial banks were nationalized in 1982 by presidential decree under the presidential administration of Jose Lopez Portillo (1976 -1982). Under the presidential administration of Miguel de la Madrid Hurtado (1982-88), private sector institutions were allowed to perform the so-called nonbank functions of the banks, and the radical liberalization and privatization process of the Mexican commercial banking system began in 1987. This radical liberalization and privatization process was completed in 1991-92, under the presidential administration of Carlos Salina de Gortari (1988-94).

⁴ As shown by Petrucelli and Woolford (1984), the necessary and sufficient condition for the basis to be stationary is: $\rho_1 < 0$, $\rho_2 < 0$ and $(1 + \rho_1)(1 + \rho_2) < 1$.

Appendix

To endogenous search for the structural break possibility in the time series data R_t , Perron (1997) procedure with the intercept, slope, and the trend dummy is specified as:

$$R_t = \mu + \theta DU + \alpha t + \gamma DT + \delta D(T_b) + \beta SP_{t-1} + \sum_{i=1}^k \psi_i \Delta R_{t-i} + v_t$$

where $DU = 1(t > T_b)$ is a post-break constant dummy variable; t is a linear time trend; $DT = 1(t > T_b)$ is a post-break slope dummy variable; $D(T_b) = 1(t = T_b + 1)$ is the break dummy variable; and v_t are white-noise error term. The break date, T_b , is selected based on the minimum t-statistic for testing $\beta = 1$ (see Perron, 1997, pp. 358-359). Estimation results using the Mexican lending rate and deposit rate, LR_t and DR_t , with l_t and d_t denoting white noise error terms, are summarized in Table 3:

Table 3: Perron's Endogenous Unit Root Test, Mexican Monthly Data, 1995:2 -2010:1

$$LR_t = 6.0649 - 4.9161DU - 0.0503t + 0.0481DT + 0.7119D(T_b) + 0.8211LR_{t-1} + l_t$$

$$(3.7312^*) \quad (-3.3290^*) \quad (2.6699^*) \quad (2.5937^*) \quad (0.4283) \quad (20.5026^*)$$

No. of augmented lags: $k = 12$ Break Date: March 2001 $t(\alpha = 1) = -4.4673$

$$DR_t = 3.3525 - 2.7573DU - 0.0339t + 0.0323DT + 0.4110D(T_b) + 0.8621DR_{t-1} + d_t$$

$$(3.2222^*) \quad (-3.1133^*) \quad (-2.7370^*) \quad (2.7282^*) \quad (0.6020) \quad (26.1545^*)$$

No. of augmented lags: $k = 12$ Break Date: March 2001 $t(\alpha = 1) = -4.1843$

Notes: Critical values for t-statistics in parentheses: Critical values based $n = 100$ sample for the break date (Perron, 1997). “*” indicates significance at 1 percent level.

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Life Insurers' Switch to Private Debt Holdings: The Duration Model**Fan Liu, PhD****Abstract**

Life insurers as major lenders in the private debt market must have relevant characteristics to match the special needs of private debt such as having the ability to evaluate the credit quality of borrowers and performing ongoing risk monitoring. The purpose of this paper is to examine the determinants of life insurers' switch from no private debt holdings to private debt holdings. The results suggest that life insurers with fair or good financial strength rating scores, facing stringent regulation, having more percentage of foreign holdings and less cash holdings are more likely to switch from no private debt holdings to private debt holdings.

Introduction

In the United States, private placements (including debts and equities) are offerings of debts or equity securities that are not registered with the Securities and Exchange Commission (SEC). They are generally fixed-rate, intermediate-to-long-term securities, with individual issues being for moderately larger amounts and often including restrictive covenants and can be thought of as lying between bank loans and public bonds in their maturity, size and tightness of covenants. In 1990, the SEC further adopted Rule144A to develop a new market for privately placed debt which splits the private debt market into two segments: the traditional market and a new Rule144A market.

Lenders in the private debt market engage in extensive credit evaluations of the potential borrowers and perform ongoing loan monitoring since borrowers in this market tend to be less well-know companies. They normally hold the debt to maturity because private debt is less liquid than public debt. The long-term character of private debt together with its relatively lower prepayment risk facilitates duration matching with life insurer fixed-rate liabilities. Life insurance companies are major lenders in the private debt market (both in the traditional market and Rule144A market). At year-end 2003, the value of U.S. issued private debt was \$491.4 billion (see Table I) and life insurers held \$437 billion of

total privately placed debt up to year 2003 which also included private debt issued by other countries (National Association of Insurance Commissioner). During the latest 5 years (Year2003-Year2007), the trend for life insurers to invest more in private debt market is even more apparent (see Figure 1) and the relative percentage to the public debt holdings remains stable (see Figure 2). Moreover, both holdings class distribution and maturity distribution illustrate that life insurers keep their preferences to invest within high quality class (class1 and class2) and average maturity around 5-10 years (see Figure 3 and Figure 4). All these imply that there exist some reasons for life insurers to be attracted into this market.

The purpose of this paper is to examine the determinants of life insurers' switch to private debt holdings. Drawing on the finance literature, we derive hypotheses regarding the relation between life insurers' switch decision and firm-specific characteristics. We find that life insurers with good financial quality, licensed in New York State, having more than 10% foreign holdings and less cash holdings are more likely to switch to private debt holdings.

The remainder of this paper is organized as follows. In the next section we review prior studies on private debt market. Section III provides the details of the data. Section IV elaborates the framework for empirical tests

and the main hypotheses, and specifies the variables used to test the hypotheses. Section V describes the econometric methods and our model. Section VI presents our principal findings. The paper concludes with a summary and directions for future research.

Literature Review

Prior empirical studies on private debt financing focus only on the borrower side of the market. Blackwell and Kidwell (1988) examine the cost differences between public sales and private placements of debt for a sample of public utility issues and suggest that firms minimize the cost of issuing securities by selecting the market providing the lowest transaction costs. Houston and James (1996) examines the determinants of the mix of private and public debt using detailed information on the debt structure of publicly traded corporations. Krishnaswami, Spindt, and Subramaniam (1999) empirically examine the impact of flotation costs, agency conflicts, regulation, and information asymmetries on a firm's mix between public and private debt. Denis and Mihov (2003) examine the choice among bank debt, non-bank private debt and public debt. However, all these studies neglect the important role of lenders in the private debt market.

Three studies exceptionally focus on lender side of the market. Carey et al. (1998) present empirical evidence on the existence of specialization in private market corporate lending, adding a new dimension to the public versus private debt distinctions in the literature. Pottier (2007) extends the understanding of the private debt market by being the first to examine life insurer as the major lenders in the private debt market. However, without longitudinal data framework, it is hard to permits the sign of the relationship between the explanatory variables and the decision to hold private debt to differ from that linking these variables to the volume of holdings. Liu (2013) analyzes life insurers' participation in the private debt market by

using Cragg's (1971) model. But the characteristics of life insurers which influence their decisions to switch from no-private debt holdings to private debt holdings are still unclear.

Data

The data used for our analysis are drawn from the National Association of Insurance Commissioners (NAIC) Life-Health Annual Statement database and Best's Key Rating Guide (A.M. Best) Life-Health Edition database beginning in the year 2003 through the year 2007. These data sets capture life insurer private debt holdings, financial strength rating and other firm-specific characteristics.

For the purpose of our analysis, private debt holdings are defined as non-Rule 144A private debt consistent with the earlier discussion regarding the traditional private debt (Cummins, 1977). Firms must have non-negative private debt holdings, positive total net admitted assets and total net premiums, and at least an 'F' letter rating from Best's Key Rating. The sample consists of unaffiliated and affiliated insurers based on the individual level. For each year, the data may have different number of firms because of the exit or entry of new life insurers but for the same insurer, it cannot cycle on and off repeatedly. The final unbalanced panel includes 1014 observations for the 5 year window.

A total of 297 life insurers which do not hold any private debt initially are included in the analysis that follows. Of all these life insurers, 95 (or 11.20%) experienced switch to private debt holdings at least once (see Figure 5 and Table II). We focus on each life insurer's first time switch to private debt holdings in the remaining analysis.

Hypotheses

This study examines the characteristics of life insurers that accelerate or delay the duration of their decisions to switch to private debt holdings. A binary variable,

TRAD_PRIVATE, equals to one for life insurers that hold private debt, and zero otherwise.

Several insurer-specific characteristics are included in the analysis of the determinants of switch to private debt holdings. The firm characteristics are considered related to financial quality, organization form, ownership, business growth, market geographic concentration, regulatory environment, liquidity, and foreign control.

1. Financial Quality

A variable, RATING_SCORE, measured from 0 (with rating score 'F'- In Liquidation) to 9 (with rating score 'A++'- Superior) from A.M. Best is used as a proxy for financial quality. The Best's Financial Strength Rating is an independent opinion of an insurer's financial strength and ability to meet its ongoing insurance policy and contract obligations. It is based on a comprehensive quantitative and qualitative evaluation of a company's balance sheet strength, operating performance and business profile. High quality lenders convey more accurate information about the borrower's risk and those firms seeking a credible signal of positive private information will use high quality lenders. Furthermore, a lender's credit quality might also proxy for its incentive to monitor borrowers in order to protect their credit rating. As a result, life insurers with higher financial ratings are expected to accelerate their decisions to switch to private debt holdings.

2. Organization Form

A binary variable, MUTUAL, equals to one for mutual insurers and zero for non-mutual (stock) firms is used to measure organization form. Because more effective managerial control mechanisms exist in a stock firm, stock insurer should hold investments requiring more managerial discretion. On the other hand, the prior research (Garven and Pottier, 1995) suggests that the merger of the owner and policyholder functions in the mutual form mitigates the incentives for firm

owners to increase asset risk at policyholders' expense and the benefit of the mutual form is expected to be even greater in relation to stock firm where external monitoring is more limited. Thus the expected impact of organizational form on private debt holdings depends on whether agency costs associated with the owner-manager conflict or agency costs associated with the owner-policyholder conflict dominate. Latest research on private debt holdings (Pottier, 2007) argues that life insurers with mutual form have positive effects on private debt holdings. We expect that life insurers with mutual organization form are more likely to switch to private debt holdings.

3. Ownership

A binary variable, TRADED, which equals to one if the insurer is owned by a publicly-traded insurer and zero otherwise, is used as an ownership measure. Public traded life insurers are expected to lessen the risk-shifting potential related to private debt and face lower costs of asymmetric information between the firm and the outside market. Thus, we expect to see being a publicly-traded insurer accelerates the switch to private debt holdings.

4. Business Growth

We define the business growth of life insurer as

$$\frac{Premium_{current\ year} - Premium_{prior\ year}}{Premium_{prior\ year}}$$

The more rapidly the percentage of premium increases, the higher the life insurer growth rate is. While the life insurer will have more liquid to engage into the private debt market, growth also means big expansion on expenditure. If the net value of business growth for life insurers is to hold more liquid, we expect to see this has positive effect on private debt holdings. However, if the net value of business growth is to spend more on expenditure, a delay to have private debt holdings will be expected.

5. Market Geographic Concentration

Market geographic concentration, GEO_MKT_SHARE, is a function of firm's total share of the life business in different U.S. States/Possession. Mathematically, it is defined for each life insurer as

$$\sum_{i=1}^{55} \left(\frac{\text{life_business_in_state}_i}{\sum_{i=1}^{55} \text{life_business_in_state}_i} \right)^2$$

The value of market geographic concentration is between zero and one, and larger value implies more geographically concentrated for the life insurer. Geographic concentration for the life insurer in the previous literature is assumed not to have big influence on the investment decision comparing with geographic concentration for the nonlife insurer (Proper and Casualty). But since we define it here as the market geographic concentration for life business instead of annuity, it may bring different level of risks for different specific areas. We expect to see this variable to have some impacts on the life insurers' switch decisions.

6. Regulatory Environment

A binary variable, NY_LIC that equals to one if the insurer is licensed in New York State, is used as a proxy measure for regulatory environment. Based on a review of state investment regulation, it doesn't appear that insurance regulators impose any limitations specifically on private debt holdings. However, New York State insurance regulation is considered especially stringent and applies an extraterritorial basis (Pottier and Sommer, 1998). Thus, an insurer licensed in New York State must adhere to New York State regulations wherever the insurer operates. Consequently, positive effect is expected to see.

7. Liquidity

The percentage of cash holdings, CASH, is used as a proxy for the liquidity level of the life insurer. It is defined as

$$\frac{\text{cash_and_short_term_investment}}{\text{invested_assets}}$$

Higher rate of cash holdings may offset the reduction in liquidity associated with relatively more private debt holdings. Thus, we expect to find positive effect on the switch decisions.

8. Foreign Control

A binary variable, FOREIGN, equals to one if any foreign (non-United States) person or entity directly or indirectly control 10% or more of the life insurer is used as a measure for foreign control. The foreign control may have positive effect on the private debt holdings because of the preference to risk-taking while it may also cause obstacles which delay the holding. Selected summary statistics for the samples of insurers with private debt holdings and those without private debt holdings are shown in Table III. The differences in means between life insurers with private debt holdings and life insurers without any private debt holdings are as expected. The exceptions are organization form (MUTUAL) and ownership (TRADED). However, this can be explained by the original unbalanced panel data. We define the initial status as life insurers without any private debt holdings and by fact, life insurers with mutual as organization form and traded publicly are investors who buy majority of private debt in the market.

Methodology

A variety of econometric methods are available for examining time-duration data. Among the most common are various forms of proportional hazards model that estimate the effects of various factors on the probability that a spell will end at some point in time, given that it has not previously ended. Denoting T as the individual life insurer's choice-switch spell length and t as the current time, this probabilities is as follows:

$$P(t \leq T \leq t + \Delta | T \geq t)$$

where Δ represents a small increment of time. The limit of $[P(t \leq T \leq t + \Delta | T \geq t)]/\Delta$ as

Δ goes to zero is known as the hazard rate. It is typically assumed that T has a continuous probability distribution function, given by $f(t)$, where the associated cumulative distribution function is

$$F(t) = \int_0^t f(s)ds = P(T \leq t).$$

The hazard rate $\lambda(t)$ is the rate at which spells are completed immediately after t , given that they have lasted at least until t , and is related to the survival function

$$\lambda(t) = \lim_{\Delta \rightarrow 0} \frac{P(t \leq T \leq t + \Delta | T \geq t)}{\Delta} = \lim_{\Delta \rightarrow 0} \frac{F(t + \Delta) - F(t)}{\Delta S(t)} = \frac{f(t)}{S(t)},$$

where $S(t) = 1 - F(t) = P(T \geq t)$ is the survival (or survivor) function.

Empirically, hazard models express the hazard rate as a multiplicative function of some baseline hazard, $\lambda_0(t)$, and an exponential function of a set of covariates as

$$\ln(t) = \beta_0 + \beta_1 * \text{RATING_SCORE} + \beta_2 * \text{MUTUAL} + \beta_3 * \text{TRADED} \\ + \beta_4 * \text{GEO_MKT_SHARE} + \beta_5 * \text{CASH} + \beta_6 * \text{GROWTH} \\ + \beta_7 * \text{NY_LIC} + \beta_8 * \text{FOREIGN} + \ln(\tau)$$

The selection of an appropriate distribution for the baseline hazard (or τ in the AFT metric) is typically based on an examination of the empirical hazard exhibited by the data in question. The relatively smooth empirical hazard exhibited by our data (see Figure 6 and Figure 7), which is characterized by high initial hazard rates followed by gradually declining rates, indicates that the log-normal or log-logistic is most appropriate.

Empirical Results

The results of the accelerated failure time model that analyze the determinants of switch to private debt holdings are presented in Table IV and Table V with using log-normal distribution and log-logistic distribution. Table IV captures the results by reporting coefficients and Table V by time ratios.

The coefficient of the insurer financial quality variable (RATING_SCORE) is negative (as expected) and very significantly related to

$$\lambda(t) = \lambda_0(t) \exp(X\beta),$$

where β represents the usual vector of coefficients. Estimation of this type of model involves making a decision about the functional form of the baseline hazard.

A direct extension of the previous proportional hazard specification is the accelerated failure time (AFT) metric, which is used in this paper. Defining τ as $\tau = \exp(X\beta) t$, and with some manipulation and rearranging, the log of the failure time t can then be conveniently expressed as a linear function of a set of relevant covariates

$$\ln(t) = X\beta + \ln(\tau).$$

The natural log of τ represents something of an error term in the above equation. The distribution of it determines the particular model in much the same way as the choice of functional form for the baseline hazard in the proportional hazards metric. Specifically, we have parametric model as follows,

private debt holdings with 1% level, after controlling other characteristics. Transformed into time ratio, it indicates that the effect of one-unit increases in life insurer's credit rating score speeds up the probability of switching to private debt holdings by 30% for log-normal distribution and 36% for log-logistic distribution.

Contrary to the expectation, the coefficient of liquidity (CASH) is positive with 1% significance level (5% for log-logistics). As discussed earlier, we expect to see negative value here if higher rate of cash holdings may offset the reduction in liquidity associated with relatively more private debt holdings. Further, this contradicts with the static result shown by Pottier (2007). In his paper, he finds that life insurers with large percentage of cash holdings choose to hold private debt even though he also gets the same difference in means from summary statistics as we do.

However, results from our duration model show those life insurers who don't hold private debt but with large cash holdings delay their switch to private debt holdings, which consists with the difference in means from our previous summary statistics. This can be explained by the investment preference of life insurers initially with no any private debt holdings instead of all life insurers in Pottier's paper.

The coefficients of regulatory environment (NY_LIC) and foreign control (FOREIGN) are both negative and significant with 10% level in log-normal distribution model, which means getting license in New York State or having more than 10% foreign control speeds up the probability of life insurers' switch to private debt holdings by 27% and 33% respectively.

The coefficients of ownership (TRADED), organization form (MUTUAL), Market Geographic Concentration (GEO_MKT_SHARE) and growth (GROWTH) are insignificant but most of them have the positive or negative effects as we expect with only exception for organization form which we have explained earlier. From results we can see that publicly traded life insurers with less geographic concentration for life business are more likely to switch to private debt holdings while the effect of growth rate is unpredictable.

The potential problems of multicollinearity and heterogeneity are considered. From the Spearman's correlation coefficient table (see Table VI), multicollinearity can hardly be considered as problem in our model. Moreover, we implement both gamma distribution and inverse-Gaussian distribution for controlling unobserved heterogeneity.

However, considering our initial log-normal or log-logistic regression, it is not easy to get convergence when implementing unobserved heterogeneity. Besides, since AFT model with log-normal distribution and AFT model with log-logistic distribution are not nested models, we prefer to use AFT model with log-normal distribution if comparing the value of the Akaike information criterion (AIC).

Conclusions

This paper extends our understanding of the private debt market by examining the major lenders in the private debt market. We analyze the characteristics of life insurers that determine their switch decisions to private debt holdings in the private debt market.

Our empirical results indicate that life insurers with fair or good financial strength rating scores, facing stringent regulation, having more percentage of foreign holding control and less cash holdings are more likely to switch from no private debt holdings to private debt holdings.

Because this study provides some of the first findings that use longitudinal data, a number of questions remain unanswered. First, the investment decision performed remarkably importance for life insurers both from individual firm level and consolidated group level. Their decisions to switch to private debt holdings may be influenced differently. Second, our multivariate analysis has only considered life insurers' first switch for investment decisions but not repeated switch. Finally, future research may consider to separate life insurers who don't have access to private debt investment from life insurers who only invest in public debt but having access to private access to private debt investments.

Table I Private Placements in the U.S., Year2003-Year2007 (\$ billions)

Year	Value of U.S. private placements			Number of U.S. private placements		
	Debt	Equity	Total	Debt	Equity	Total
2003	491.4	28.9	520.3	2,635	534	3,169
2004	570.4	32.1	602.5	2,729	560	3,289
2005	554.7	57.7	612.4	2,887	516	3,403
2006	523.7	73.5	597.2	2,705	596	3,301
2007	555.2	72.0	627.2	1,933	512	2,445

Source: Insurance Information Institute, Financial Service Fact Book

Table II Overall First Switch Rates (Year2003-Year2007)

Years	Switch	Cumulative Switch Rate
2003-2004	46	5.42%
2004-2005	29	8.84%
2005-2006	8	9.79%
2006-2007	12	11.20%

Table III Selected Summary Statistics with and without Private Debt Holdings
TRAD_PRIVATE =1

Variable	Obs	Mean	Std. Dev.	Min	Max
cash	201	0.075754	0.122327	0	0.717526
foreign	201	0.19403	0.396439	0	1
geo_mkt_share	201	0.373178	0.380442	0	1
growth	201	0.152552	0.278656	0	1
mutual	201	0.019901	0.140007	0	1
ny_lic	201	0.323383	0.468936	0	1
rating_score	201	7.99005	1.212395	2	9
traded	201	0.079602	0.271352	0	1

TRAD_PRIVATE =0

Variable	Obs	Mean	Std. Dev.	Min	Max
cash	813	0.136717	0.179779	0	0.999928
foreign	813	0.098401	0.298039	0	1
geo_mkt_share	813	0.437633	0.38718	0	1
growth	813	0.163368	0.275928	0	1
mutual	813	0.02829	0.165903	0	1
ny_lic	813	0.177122	0.382007	0	1
rating_score	813	7.311193	1.077232	2	9
traded	813	0.110701	0.313955	0	1

Table IV Coefficients for AFT Model with Log-normal Distribution and Log-logistics Distribution

VARIABLES	(1) Log-normal (AFT) Coef.	(2) Log-logistic (AFT) Coef.
ny_lic	-0.318* (0.181)	-0.260 (0.183)
foreign	-0.413* (0.221)	-0.334 (0.219)
traded	-0.0847 (0.250)	-0.0940 (0.263)
mutual	0.570 (0.620)	0.486 (0.651)
rating_score	-0.359*** (0.0770)	-0.461*** (0.0963)
geo_mkt_share	0.158 (0.202)	0.161 (0.204)
cash	1.644*** (0.577)	1.613** (0.637)
growth	-0.000550 (0.275)	0.0310 (0.289)
Constant	4.251*** (0.619)	5.001*** (0.768)
Observations	848	848
Log-likelihood	-219.1134	-221.18333
AIC	458.2268	462.3667

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

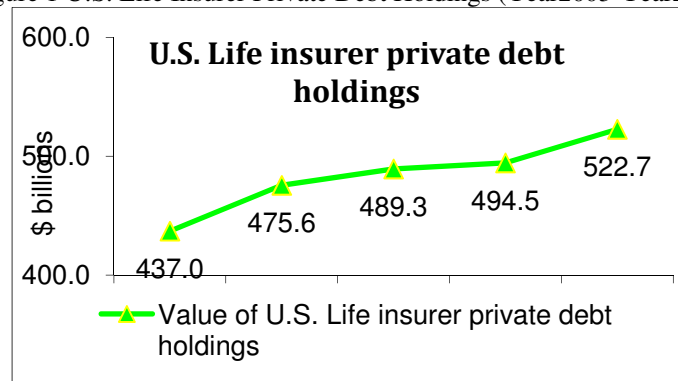
Table V Time Ratio for AFT Model with Log-normal Distribution and Log-logistics Distribution

Variable	Log-normal (AFT) Time-ratio	Log-logistic (AFT) Time-ratio
ny_lic	0.7275256	0.7709335
foreign	0.6614687	0.715809
traded	0.9187768	0.9103092
mutual	1.767693	1.625496
rating_score	0.6987021	0.6309281
geo_mkt_share	1.17101	1.174673
cash	5.178044	5.017924
growth	0.9994501	1.031478

Table VI Spearman's Correlation Coefficient Across 297 Firms

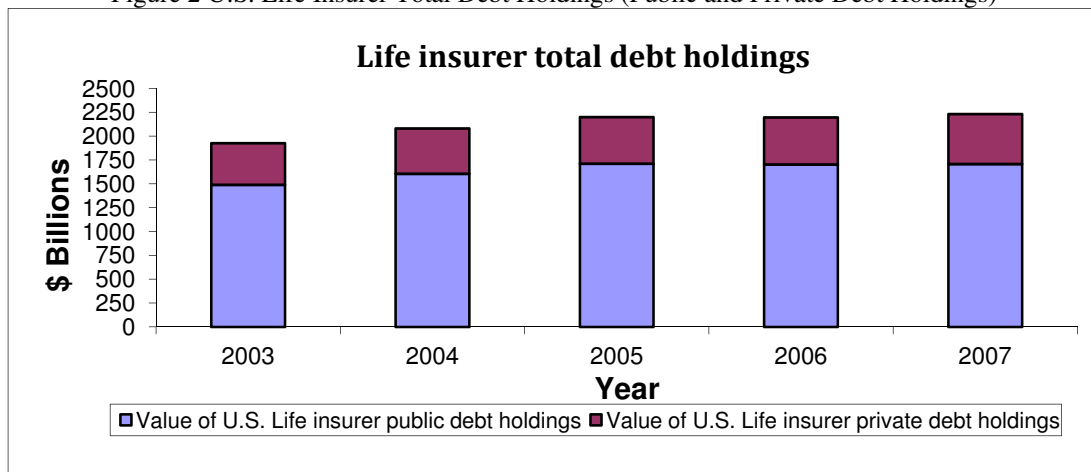
	cash	foreign	geo_mkt_share	growth	mutual	ny_lic	rating_score	traded
cash	1							
foreign	0.0861	1						
geo_mkt_share	0.0977	-0.1456	1					
growth	0.1279	-0.1029	0.0368	1				
mutual	0.0854	-0.0603	-0.0753	-0.024	1			
ny_lic	0.0646	0.0415	0.0127	0.0395	0.0369	1		
rating_score	0.1095	0.1776	-0.107	0.0739	-0.0907	0.2931	1	
traded	-0.012	-0.0745	-0.1205	0.0883	-0.0565	0.0171	-0.0944	1

Figure 1 U.S. Life Insurer Private Debt Holdings (Year2003-Year2007)



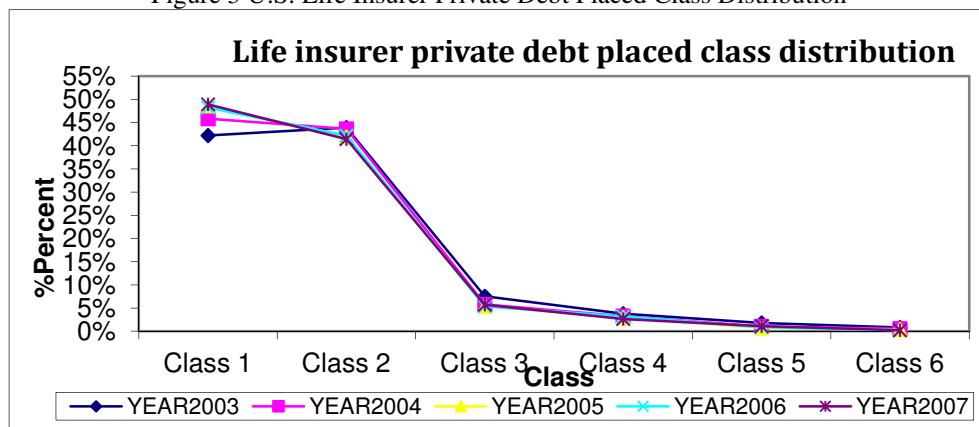
Source: Insurance Information Institute, Financial Service Fact Book

Figure 2 U.S. Life Insurer Total Debt Holdings (Public and Private Debt Holdings)



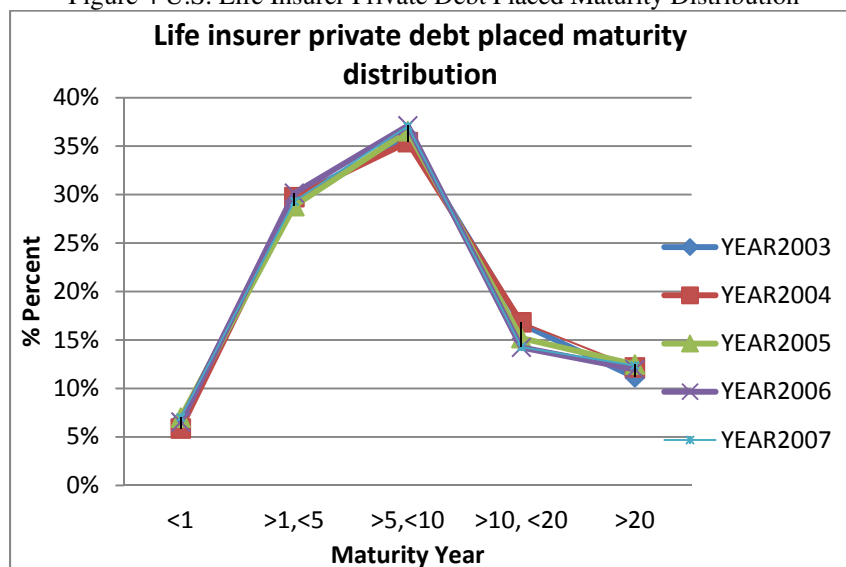
Source: National Association of Insurance Commissioner (Year2003-Year2007)

Figure 3 U.S. Life Insurer Private Debt Placed Class Distribution



Source: National Association of Insurance Commissioner (Year2003-Year2007)

Figure 4 U.S. Life Insurer Private Debt Placed Maturity Distribution



Source: National Association of Insurance Commissioner (Year2003-Year2007)

Figure 5 Cumulative First Switch Rates

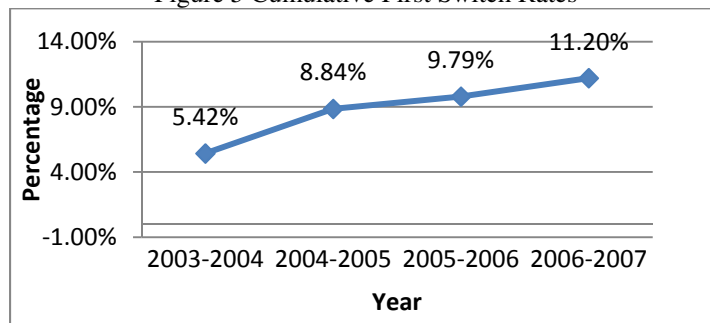


Figure 6 Kaplan-Meier Survival Estimates and Smoothed Hazard Estimates

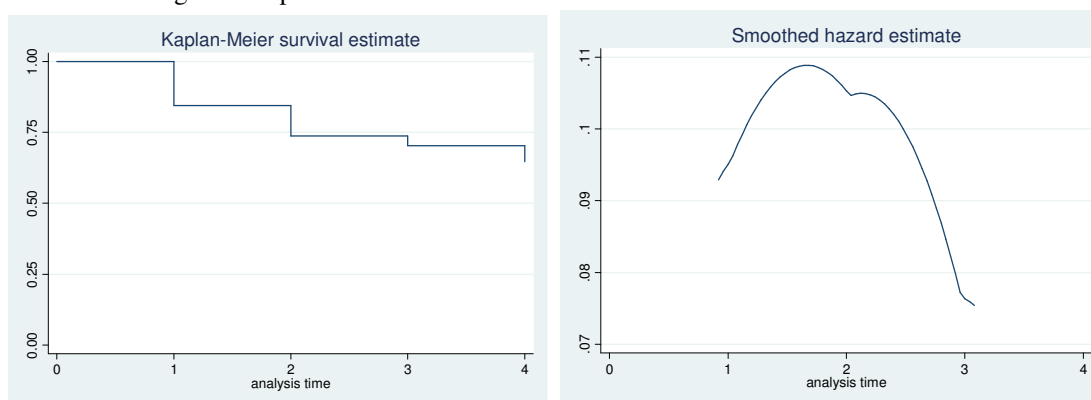
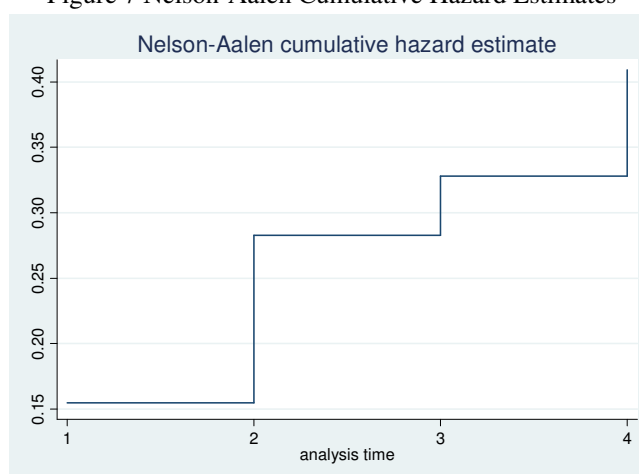


Figure 7 Nelson-Aalen Cumulative Hazard Estimates



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A Framework for Explaining Accounting Students' Formal Communication GAP

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Abstract

This paper introduces a framework that explains how innovations in communication technology have affected students' communication skills. Our framework suggests that new communication mediums have reduced students' exposure to contexts requiring formal communication and increased students' exposure to contexts utilizing informal communication. As a result, today's accounting students have less formal communication experience, thus less developed formal communication skills than their predecessors. To mitigate this communication gap, we discuss adapting the accounting classroom to familiarize, hone, and instill formal communication skills.

Keywords: communication skills, communications gap, informal communication, flipping the classroom

Introduction

Accounting students inappropriately informal communication style has been decried by both college educators and industry professionals (Mulling, 2013). Though faculty may no longer consider informal communication unusual, it was relatively unknown only one generation ago and it remains inappropriate for many professional workplace settings (Vance and Stephens, 2010; Bauer, 1996). The following anecdote illustrates the inappropriately informal communication style exhibited by some contemporary accounting students:

A partner in a CPA firm recently received a resume and cover letter from an accounting student who possessed a good GPA, was active in beta alpha psi, and seemingly had prepared herself for a professional career in public accounting. However, upon reading the student's cover letter, the partner rejected the application because the student had inappropriately used the letter "u" in place of the word "you" and "thnx" as a replacement for "thank you." When faculty followed up with the student, she said she was unaware that the

communication style she used in applying for the job was inappropriately informal.

Many similar informal communication anecdotes are shared on College Misery (2013), a popular blog where faculty members share their collegiate experiences. Both anecdotes and accounting research (Christensen and Rees, 2002) suggest today's accounting students may not sufficiently develop the formal communication skills required to be successful in the accounting profession during their college education.

There are serious consequences associated with accounting students' failure to develop formal communication skills during their college years. In the example above, the student's inappropriately informal communication style prevented her from obtaining the job she wanted. More frequently, an accounting student obtains a job without possessing the requisite formal communication etiquette, leading to frustration and embarrassment for those who interact with the student in a professional setting. Thus, failing to obtain and hone formal communication skills leads to a "communication gap" between students'

informal communication style and the more formal communication style expected of professionals. The communication gap is of particular concern to the accounting profession as there is some empirical evidence that suggests accountants are already perceived to lack communication skills (Friedman and Lyne, 2001). Therefore, it is not surprising that employers, managers, and professors have all expressed concern regarding the quality of current accounting students' soft skills (Cohn, 2013; Christensen and Rees, 2002).

This paper contributes to the literature by introducing a framework that proposes innovations in communication technology have reduced students' exposure to contexts requiring formal communication. Accordingly, we suggest it is not surprising that today's students may lack the formal communication skills held by their predecessors because today's students have less formal communication practice.¹ While we recognize that the primary focus of the classroom should be student learning, we suggest it is important that students understand how to formally communicate. As a result, we contribute to accounting pedagogy by identifying means by which educators can help mitigate the communications gap. We suggest adapting the accounting classroom to familiarize, hone, and instill formal communication skills.

The rest of our paper is organized as follows: in the next section we identify how technological innovations have changed

communication norms. Then, we explain how changing communication norms have impeded the development of formal communication skills. Finally, we identify ways the classroom can be adapted to instill formal communication skills. We conclude by summarizing our key contributions and by identifying limitations and opportunities for future research.

Technological Innovations and Communication Norms

The current generation of accounting students grew up in an era categorized by tremendous advancements in communication technology. In the span of one generation, entirely new mediums of communication, such as e-mail, text messaging, and social media, have not only been introduced but have become ubiquitous.² Generally, using these new communication mediums ("new mediums") requires some form of electronic device, but more significantly the new mediums enable individuals to remain in communication with each other asynchronously and without regard to physical proximity (Ijsselsteijn, van Baren, and van Lanen, 2003).³ However, since new mediums do not require physical proximity or temporal synchronization, many of the verbal and non-verbal cues associated with traditional mediums are no longer present, leading communicators to apply different communication norms (i.e., "etiquette").

Research finds that when verbal and non-verbal cues are removed, social presence cues are lost (Short, Williams, and Christie, 1976; Rice, 1993) and communication becomes more depersonalized. The literature suggests depersonalization encourages self-centeredness and anti-social behavior (Sproull and Kiesler,

¹ We define formal communication as the communication etiquette that is appropriate for a student to use when they are communicating with an individual in a non-peer relationship. Examples of non-peer relationships are numerous, such as a student-professor relationship, a student-employer relationship, and student-parent relationship. We recognize that our definition of "formal communication" connotes the existence of hierarchical relationships, which is admittedly somewhat unpopular with regards to recent societal trends which take a more egalitarian tone, suggesting that everybody is a peer and nobody should be thought to hold positions of "superiority."

² We define communication mediums as those permitting individuals to share information with each other.

³ The principal constraint of these new technological innovations is connection to an internet or telecommunications signal. However, given the communication infrastructure of the United States circa 2013, such a connection is widely available.

1986; Siegel, Dubrovsky, Kiesler, and McGuire, 1986), leading individuals to communicate with each other more as objects than as people (Williams, 1977). As the communication medium becomes more indirect, that is less rich in social cues, the manner in which the message is communicated becomes increasingly informal because communicators cannot use social cues, like body language and facial expressions, as feedback to detect when an individual's behavior is perceived as inappropriate or rude by the other party. Further, as communication becomes more indirect, the immediacy of social cues becomes diminished, causing individuals to feel increasingly comfortable saying what comes to mind. This explains why the content of messages communicated via new mediums has become less formal.

Additionally, the etiquette associated with new mediums is not as well established as traditional forms of communication. Thus, it is not altogether surprising that faculty and practitioners are concerned about receiving messages which were previously considered unheard of since the norms of communication behavior are less defined for new communication mediums. While accounting professionals may expect etiquette surrounding new communication mediums to be no different than traditional communication mediums, assuming the norms of traditional communication mediums to automatically apply to new communication mediums seems a bit presumptuous. For example, when considering the following student messages were sent via email, the level of informality contained is not altogether unexpected in light of the indirectness of the communication medium itself:

"Hello Professor Bauer, I will not be in class today, because it is just too beautiful a day out to be inside. I hope you're not too dissatisfied [sic]. Here is Thanks again!!" (Bauer, 1997)

"I have just returned from a trip I took with my father. It was very exciting that I got to go ... to Denmark, Germany and ... Finland.... I need to make up the quizzes I have missed, and am willing to do so, whenever it is convenient for you. If it is possible, could you please let me know basically [sic] what the quizzes covered? You can contact me at the above E-Mail address. Thank you for your time." (Bauer, 1997)

In the past, individuals communicating the above messages would have been required to do so in a face-to-face setting containing more established norms of behavior and richer social cues. Therefore, such messages may have been relatively rare because the social cues inherent in face-to-face communication would have alerted the communicator he was being inappropriately informal, prompting him to maintain a sense of decorum for fear of provoking an immediate and negative response from the person receiving the message. However, as a communication mode moves to environments less rich in social cues, such as a student sending their professor an email from the safety and comfort of their home, individuals will become increasingly comfortable stating whatever springs to mind because there is no risk of a direct, immediate response. Because new communication mediums are less direct, thus less rich in social cues, such mediums have likely affected communication norms.

Since young individuals integrate technology into their lives faster than the general population (Gonsalves, 2006), the communication norms associated with new mediums have disproportionately affected younger generations. Unlike previous generations who entered the workforce before new mediums were ubiquitous, today's accounting students have never known a time

when these mediums did not exist. As a result, younger generations have no frame of reference to draw upon in determining the appropriateness of using a specific communication medium to convey a message. For example, younger employees see little wrong with informing their boss via text message that they will be absent from work due to illness (Mirror, 2011), whereas older employees may feel it appropriate to communicate the message via the telephone. As new mediums are popular forms of communication among students, it should come as no surprise that these new mediums have affected students' communication style.

Finally, since new mediums permit individuals to communicate at almost any time from almost anywhere, individuals likely perceive new mediums to be the most convenient way to communicate a message in many situations. As a result, new mediums have eliminated the need for individuals to engage in face-to-face or telephone communication in many circumstances. Accordingly, new mediums have likely reduced the use of traditional communication mediums in favor of newer, less direct mediums. Thus, while new mediums have made it more convenient for individuals to communicate with each other, the loss of social cues has likely increased the informality of the messages exchanged.

As a result, because today's students have less practice communicating formally vis-à-vis prior generations, it should come as no surprise that they possess weaker formal communication skills. Students' lack of experience with formal communication may help to explain why they seemingly lack formal communication skills.

To be successful in the accounting profession, it is important that students acquire formal communication skills. As faculty members are responsible for preparing students to enter the profession, we suggest faculty should play an active role in helping accounting students develop their formal communication skills. In

the next section, we identify ways the classroom can be used to develop students' formal communication skills.

Developing Students Communication Skills

As faculty charged with preparing the next generation of accounting leaders, we believe faculty have an obligation to educate students in the norms associated with professional communication so students are not caught off guard when they enter the business world. Though we understand there may be considerable resistance from faculty, who may feel their primary obligation is to provide students with knowledge of accounting principles, this definition of a professor's role is too narrow. We subscribe to the argument that a good professor is one who prepares his or her students to be successful in their field of study. Thus, educating students in the norms associated with professional communication etiquette does not fall outside of the professor's charge.

In this section, we provide suggestions on how new mediums can be redirected to facilitate student learning in a classroom environment. We select this approach because it gives students the opportunity to see elements of formal and informal communication and to learn when each is appropriate. Our suggestions are in line with the evolution of technology into the modern classroom and to teaching innovations like flipping the classroom. Our goal is to begin the development of a roadmap that will provide a new perspective in accounting education by providing examples of teaching approaches that are conducive to using technology that students may find appealing. Though we recognize that flipping the classroom and virtual discussions are not new ideas, as both have been suggested by other academics as ways to improve student learning, we believe these two approaches are especially suited to the current generation of students because they encourage communication while utilizing technology students are familiar with.

Flipping the Classroom

Today's technology savvy-students do not necessarily thrive in a lecture style class. For decades, educational researchers have questioned the effectiveness of the lecture approach, concluding that the traditional lecture is not an effective method for facilitating student learning. At best, lectures disseminate knowledge that might or might not be retained (Van Eynde and Spencer, 1988). Some studies suggest that students in lecture-based classrooms fail to retain as much material as students in active learning classrooms (Van Eynde and Spencer, 1988). Active or collaborative learning methods like flipping the classroom focus on learning rather than teaching. When students become active participants in the classroom they utilize higher order thinking skills such as analysis, synthesis, and evaluation. The result is that students learn how to apply concepts, resulting in greater learning.

Flipping the classroom can be implemented using the technology that today's students are comfortable with. Prior to receiving an in-class assignment, on-line lectures or other media can be used to provide students with basic concepts. While flipped classrooms may be live or on-line, if the class is live, class time can be devoted to interactive discussions where students solve complex problems using the concepts provided to them prior to class. Thus, the class functions more as an interactive lab than a sterile lecture hall. If a live classroom is not used, students can interact using various electronic media. In a flipped classroom, student learning predominantly takes place as the students interact with each other to solve case or problem assignments. The professor's role shifts to observing progress and offering assistance on an as-needed basis by circulating among students in the classroom or by monitoring on-line communication.

Students respond to a flipped classroom because it incorporates inter-personal communication, encourages use of technology

for research, and focuses on interactive problem solving. By permitting students to work together using whatever communication medium they prefer, students learn to manage their time efficiently because they have periodic reporting assignments. The assigned tasks should be complex enough to require critical thinking and may culminate in a final product that is presented to the class. This presentation can model the type of presentations students will need to be comfortable giving in their future accounting careers. Grading is most effective when based upon the quality of the solution, the degree of team involvement, and the quality of the presentation. We suggest fostering an informal communication style until the class presentation, where students can be required to present their results using formal communication norms. Flipping the classroom allows students to learn using the informal communication style they are accustomed to, but instills the importance of formal communication by requiring students to change their communication style when presenting their results. We suggest this approach both exposes students to formal communication styles and demonstrates that informal communication is not always appropriate for every task context.

Virtual Discussion

Learning management tools like Desire-to-learn or Blackboard are already widely used in higher education. Students like these electronic tools because they provide timely information. Outlines, handouts, and grades can be updated quickly by the professor and accessed in real-time by students. Tools available in most learning management applications such as chat, email, and gradebook are readily accepted by students. Further, this technology is effective as an information disseminator in a live classroom or can be used to facilitate a totally online class.

A useful, but sometimes overlooked tool provided with most learning management

systems is the discussion function. This tool can be used to engage students in discussions that can be more effective online than in a face-to-face classroom setting. For example, in an online discussion, even the shyest student will often participate in the discussion. Students who are uncomfortable participating in a live classroom may be willing to post their ideas online because they are accustomed to using informal communication technology like social media to make their opinions known. Unlike the traditional classroom discussion where one student speaks at a time, online discussions permit students to post their ideas simultaneously so that all are actively engaged. Further, to encourage students to formulate their own ideas, the learning management system can be set so that students must make a post before they are allowed to see posts made by other students. This type of virtual discussion can generate a more in-depth discussion than is possible in a live classroom. We suggest assessing learning by using a record of the discussion, which is archived by the system. To promote the development of formal communication skills, we suggest the professor establish some communication etiquette “ground rules” at the beginning of the class. During the semester, we suggest the professor at least occasionally praise students applying appropriate communication etiquette, while identifying how students communicating in an inappropriately informal manner can improve their communication style. By tying some portion of the discussion grade to communication style, the professor can take advantage of peer pressure and achievement pressure to motivate students to learn and apply formal communication etiquette. Thus, virtual discussion can be an interactive, collaborative learning environment from which to impart formal communication skills to students.

Conclusion

In this paper we proposed a framework to identify how innovations in communication

technology (i.e., new communication mediums) have caused communication norms to become more informal. Our framework also identifies how these new mediums have reduced students’ exposure to formal communication contexts, impeding their development of formal communication skills.

While our framework identifies how technology has shifted the norms of interpersonal communication towards informality, we emphasize the need for embracing and re-directing these new mediums. Banning the use of new mediums in the classroom is misguided and only results in the classroom becoming increasingly removed from the outside world. We advance flipping the classroom and virtual discussion as two means by which professors can use the new mediums to facilitate learning and impart formal communication skills, thereby adapting to the times instead of becoming overcome by them.

While we developed our framework by drawing upon the findings of prior research, we acknowledge our framework is built upon logical argument but not tested or supported by empirical evidence. Thus, future research may find it advantageous to empirically test our framework to contribute to the academic conversation regarding the efficacy of the two learning means suggested in this article.

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The Information Asymmetry of A and B Shares in China: Which One Dominates the Market?

Anthony H. Tu

Abstract

This study examines the possible information asymmetry between A-share (domestic investors) and B-share (foreign investors) markets in China. We use and modify the information share model, proposed by Hasbrouck (1995), to analyze the contribution of each market to the price discovery. The modified information share model allows us to distinguish two sources of information asymmetries between markets: volume-related (private) information shocks and volume-unrelated (public) information shocks. The empirical evidence indicates that, as the two markets are completely segmented, the price discovery contribution of B-shares is slightly higher (lower) than that of A-shares in private (public) information shocks. This implies that domestic individual investors in A-shares market have better public information, whereas foreign institutional investors in B-shares market have better private information. After the B-share market is opened to domestic investors, the information advantage of B-shares no longer exists. A-shares have the information advantage over B-shares in both private and public information shocks.

Keywords: Segmented markets; Chinese stock markets; Information shares; Information asymmetry; error correction model

JEL Classifications: G14; G15

Introduction

In China, the same firm can issue A shares and B shares. Domestic investors can only buy A shares and foreign investors can only buy B shares^a. The shares are identical in terms of voting power and dividend claims. Due to the existing regulations, the amount of outstanding B shares is always smaller, so foreign investors are forced to be minority shareholders. The outcome is that the equity of the same firm is traded at the same time, at the same exchange, but by two different investor groups and at quite different prices. Typically, A shares trade at a premium over B shares (Fung et al. (2000), Chen et al. (2001), Karolyi and Li (2003), Mei et al. (2005)).

This study proposes to examine whether foreign investors (B-shares) are at an information advantage (or disadvantage)

relative to domestic investors (A-shares)^b. Understanding this may lead to improved predictions that can benefit both policy-makers and market-participants. Calvo and Mendoza (2000) argue that the information disadvantage of foreign investors will cause contagions across international markets.

Several factors can cause information asymmetry between domestic and foreign investors in China. Foreign investors in China are mainly big financial institutions. Compared with the domestic investors, foreign institutional investors can, in general, be assumed to be more experienced, have better means of obtaining information, and have access to more advanced technology to analyze data. Thus, the presence of foreign investors can be a

^a On February 19, 2001, the authority implemented a new policy by opening the B-share market to domestic individual investors with foreign currency holdings. As a result, the A- and B-share markets are now no longer completely segmented.

^b In this paper, we define “A-share (B-share) dominates the market” if A-share (B-share) has the information advantage over the B-share (A-share), because the better informed investors always dominate the price discovery process in an asymmetric-information market.

“buy signal” for the relatively uninformed domestic investors. In this situation, the price of B shares would lead those of A shares indicating domestic investors get information from foreign investors. The above argument refers to the “institutional dominance hypothesis.” Grinblatt and Keloharju (2000) support this hypothesis using Finnish data as do Froot and Ramadorai (2001) using a cross section of data from 25 countries. Pan et al. (2001) also find that foreign investors are better informed than domestic investors in six East Asian emerging markets.

Yet, domestic investors might have the information advantage. They can better acquire relevant news from local sources and the information does not have to travel over physical, linguistic, or cultural distances. This refers to the “local familiarity hypothesis.” Choe et al. (2001) provides convincing evidence using Korean data, Hau (2001) using German data, and Dvorak (2005) using Indonesian data. In this scenario the price of A shares would lead the prices of B shares because foreign investors learn from domestic investors.

This paper proposes to study the informational advantage (or disadvantage) of domestic investors relative to foreign investors in China’s stock market by inferring information shares, proposed by Hasbrouck (1991b, 1995), for the two classes of markets^c. The empirical methodology has been widely adopted in

investigating the informational roles of information-linked markets (Martens (1998), Huang (2002), Grammig et al. (2005), Pascual, et al. (2006)). China’s stock market is an ideal market for investigation since the A-share market and B-share market were completely segmented before February 19, 2001, which means the information advantages of A- and B-share markets can be examined under different trading mechanisms. In addition, the Chinese equity markets offer an excellent laboratory for the purpose of this study. Chinese equity markets have one of the largest individual investor populations in the world^d. Individual investor accounts make up 99.5 percent of the total number of investor accounts in the markets, whereas institutional accounts form merely 0.5 percent of investor accounts.

This study is, of course, not the first to examine information asymmetry between the markets for domestic and foreign investors in China. Chakravarty et al. (1998) and Chui and Kwok (1998) investigated information transmission between A-shares and B-shares markets. While Chakravarty, et al. (1998) finds that A-share returns lead B-share returns more than vice versa, Chui and Kwok (1998) find the opposite result. According to Chakravarty, et al. (1998), foreign investors are less informed than domestic investors because of the language barrier and different accounting standards. However, Chui and Kwok (1998) argue that foreign investors are institutional investors who are more experienced and have better means of obtaining information and more access to advanced technology to analyze data than individual domestic investors. By contrast, individual domestic investors rely solely on rumor and perception and are more likely to trade based on “noise” rather than on information. Using the forecast error variance decomposition, Yang (2003) also find that foreign investors in the Shanghai

^c The present paper is most closely related to the previous work on price discovery in multiple-trading environments. Garbade and Silber (1979) conclude that regional exchanges contribute to price discovery. Harris et al. (1995) use an error correction model to examine the discovery in IBM price on the New York, Midwest, and Pacific Stock Exchanges. Harris McNish, and Wood (2002) apply the common long-memory procedure of Gonzalo and Granger (1995) to estimate the relative contribution of the New York Stock Exchange (NYSE) for price discovery. Ding et al. (1999) uses the same methodology for comparing the contribution to price discovery of a Malaysian firm and Sime Darby Berhad uses the methodology on the Kuala Lumpur and Singapore Stock Exchanges.

^d By the end of 2002, the number of individual investor accounts opened at the Chinese stock exchanges reached 68.5 million.

B-shares market are better informed than Chinese domestic investors in both A-shares markets (Shanghai and Shenzhen).

Recently, a similar study by Chan et al. (2007) indicates that the A-shares market led the B-share market in price discovery during the period of complete market segmentation. After the B-shares market opened to domestic investors, the A-share market continues to dominate the price discovery process. Evidence further indicates that the intraday 5-minute signed volume and quote revision in the B-shares market contain information for predicting subsequent quote revision in the A-shares market. However, the analysis is based on 76 firms with sample period from Jan 10, 2000 to Nov 8, 2001.

The finding of Chan et al. (2008) also supports the information advantage of A-share market. They use the same data to examine whether the information disadvantage of foreign investors (who trade B-shares), relative to domestic investors (who trade A-shares), can explain the so-called “foreign share discount puzzle” (Fernald and Rogers (2002), Eun et al. (2001)). They construct measures of information asymmetry based on market microstructure models, and show that the cross-sectional variation in foreign share discounts can be explained by these measures, even after controlling for other factors. They further investigate the effect of the B-share market being opened to domestic investors in March 2001. The results indicate that, by allowing domestic investors to trade in the B-shares market, there is less of the information disadvantage in this market, and thus the B-share discounts become smaller.

Notwithstanding the different results in these earlier studies, a common shortcoming is that these studies base their analyses on price series data only. This paper uses and modifies the information shares model by including the influence of trading activities (trading volumes). The modified information share model allows us to distinguish two sources of information

asymmetries between markets: volume-related (private) information shocks and volume-unrelated (public) information shocks. The theoretical motivation is provided by some recent theoretical models and empirical findings. Blume et al. (1994) and Bernardo and Judd (1999) argue that volume conveys information to the market that cannot be deduced from price alone. They also develop models in which traders use previous periods’ trading volume to make inferences about the quality of informed traders’ signals which is important for estimating the payoff for the security. In Suominen’s (2001) model, traders estimate the availability of private information using past periods’ trading volumes and use this information to adjust their strategies.

Further, this study applies the model empirically to a longer period (more than 8 years) and to individual-firm stocks listed both on A and B shares, rather than the aggregated index only. As indicated by Llorente et al. (2002), the individual-firm stocks allow to efficient examination of the information role of volume. The empirical results in this paper indicate that when the two markets are completely segmented, the price discovery contribution of B-shares is slightly higher (lower) than that of A-shares in private (public) information shocks. This implies that domestic individual investors in A-shares market have better public information, whereas foreign institutional investors in B-shares market have better private information.

Finally, how the relationship changes after domestic investors are allowed to trade on the B-share market is also investigated. This happens after February 19, 2001 when the Chinese government introduced a new policy that allowed domestic investors with foreign currency holdings to trade B-shares. Consequently, the A- and B-share markets are now no longer completely segmented. Chiu et al. (2005) investigate the impact of the China stock market allowing domestic residents to invest in B-shares. Their results show that this policy improves the B-share price discount and strengthens market

integration between A- and B-shares. Moreover, the volatility transmission between A- and B-shares accelerates. The results in this paper verify the finding of Chiu et al. (2005) in a more robust sense. The remainder of this paper is organized as followed. The next section presents and

discusses the empirical model. Section 3 proposes a modified model of information shares measures, and Section 4 describes the data set and reports the empirical results. The final section summarizes the paper.

Information revelation by prices and trading volumes and the empirical model

The most common efficient parameterization of a vector of co-integrated variables is a vector error correction (VEC) model from Granger's Representation Theorem in Engle and Granger (1987). The standard error-correction representation of the market prices for a cross-listed stock is

$$\begin{aligned}\Delta p_t^A &= \alpha^A (p_{t-1}^A - \beta p_{t-1}^B) + \phi_A^A(L) \Delta p_{t-1}^A + \phi_B^A(L) \Delta p_{t-1}^B + \eta_t^A, \\ \Delta p_t^B &= \alpha^B (p_{t-1}^A - \beta p_{t-1}^B) + \phi_A^B(L) \Delta p_{t-1}^A + \phi_B^B(L) \Delta p_{t-1}^B + \eta_t^B\end{aligned}\quad (1)$$

where $\Delta p_t^i = p_t^i - p_{t-1}^i = \ln P_t^i - \ln P_{t-1}^i$, $i = \{A, B\}$. P_t^i is market i 's daily closing price at time t . The terms $\phi_k^i(L)$, for k and $i = \{A, B\}$, are stationary autoregressive polynomials in the lag operator L . The component $(p_{t-1}^A - \beta p_{t-1}^B)$ is the normalized error correction term. Presumably, β is equal to one. The α^i term is the response of the market i to a divergence from other markets' prices. If both α^A and α^B were statistically significant, the model would be facing a two-way price discovery process.

In matrix form, the equation (1) can be rewritten as

$$\Delta p_t = \alpha \beta' p_{t-1} + \Phi(L) \Delta p_{t-1} + \varepsilon_t \quad (1a)$$

where $p_t = (p_t^A, p_t^B)'$.

The information role of (trading) volume in stock markets has long been a subject of empirical research^a. In a theoretical model of Blume et al. (1994), volume provides information in a way distinct from that provided by price. As is true in most rational expectations models, that price impounds information about the average level of trader's private information, their model emphasizes that volume captures the important information contained in the quality or precision of traders' information signals. In Suominen's (2001) model, trading volume plays an important role in traders' learning. Traders estimate the availability of private information using past periods' trading volume and use this information to adjust their strategies. This accord with the empirical observation that the information contained in trading volume is important for traders' learning and affects their behavior. Finally, Suominen shows that price changes are not sufficient to characterize the evolution of conditional variance; information on trading volume is also needed.

Following the above discussion, we thus modify the traditional VEC model by including the interacting effects of price and volume. Similar to Pascual et al. (2006), we extend (1) by allowing the VEC model to be

^a Karpoff (1987) documented that stock return volatility and contemporaneous trading volume are positively correlated, and Lamoureux and Lastrapes (1990) found that trading volume in stock markets contains relevant information for predicting future volatility.

$$\begin{aligned}\Delta p_t^A &= \alpha^A (p_{t-1}^A - \beta p_{t-1}^B) + \phi_A^A(L) \Delta p_{t-1}^A + \phi_B^A(L) \Delta p_{t-1}^B + \theta_A^A(L) \Delta x_t^A + \theta_B^A(L) \Delta x_t^B + \varepsilon_t^A, \\ \Delta p_t^B &= \alpha^B (p_{t-1}^A - \beta p_{t-1}^B) + \phi_A^B(L) \Delta p_{t-1}^A + \phi_B^B(L) \Delta p_{t-1}^B + \theta_A^B(L) \Delta x_t^A + \theta_B^B(L) \Delta x_t^B + \varepsilon_t^B\end{aligned}\quad (2)$$

where Δx_t^i , $i = \{A, B\}$ is market i 's trading activity (trading volume) in t .

The generating process of Δx_t^i , $i = \{A, B\}$ is given by

$$\begin{aligned}\Delta x_t^A &= \Pi_{x,A}^A(L) \Delta x_{t-1}^A + \Pi_{x,B}^A(L) \Delta x_{t-1}^B + \Pi_{p,A}^A(L) \Delta p_{t-1}^A + \Pi_{p,B}^A(L) \Delta p_{t-1}^B + e_t^A, \\ \Delta x_t^B &= \Pi_{x,A}^B(L) \Delta x_{t-1}^A + \Pi_{x,B}^B(L) \Delta x_{t-1}^B + \Pi_{p,A}^B(L) \Delta p_{t-1}^A + \Pi_{p,B}^B(L) \Delta p_{t-1}^B + e_t^B\end{aligned}\quad (3)$$

with $\Pi_{h,k}^i(L)$, for $h = \{x, p\}$ and $k = \{A, B\}$. All lag polynomials are stationary. By substituting recursively (3) into (2), it is straightforward to obtain (1) as

$$\begin{aligned}\eta_t^A &= \theta_A^A(L) e_t^A + \theta_B^A(L) e_t^B + \varepsilon_t^A \\ \eta_t^B &= \theta_B^B(L) e_t^B + \theta_A^B(L) e_t^A + \varepsilon_t^B\end{aligned}\quad (4)$$

Similar to the framework by Frijns (2006) and Pascual et al. (2006), the shocks η_t^A , η_t^B in (1) include both volume-related and volume-unrelated shocks. Thus, the vector of $\varepsilon_t = (\varepsilon_t^A, \varepsilon_t^B)$ represents volume-unrelated shocks. We expect $E(\varepsilon_t^A, \varepsilon_t^B) \neq 0$ due to the existence of common factors. The formulation of volume-related or volume-unrelated shocks is consistent with the treatment in Hasbrouck (1991b) and Dufour and Engle (2000)^b.

The above equation (4) captures usual features that p_t^i may, due to market frictions, not instantaneously reproduce all the information trades released in t . As described in the theoretical investigation in Frijns (2006) and Pascual et al. (2006), one might be tempted to equate all “private information shocks” with volume-related shocks (e_t^A, e_t^B) and all “public information shocks” with volume-unrelated shocks $(\varepsilon_t^A, \varepsilon_t^B)$.

In equation (3), the trading volumes do not depend on the contemporaneous change in market prices. This is because trading volumes and prices are not determined simultaneously; the

^b Hasbrouck (1991b) and Dufour and Engle (2000) suggest the following *vector autoregression* (VAR),

$$\begin{aligned}\Delta q_t &= \sum_{i=1}^{\infty} a_i \Delta q_{t-i} + \sum_{i=1}^{\infty} b_i x_{t-i} + v_{1,t} \\ x_t &= \sum_{i=1}^{\infty} c_i \Delta q_{t-i} + \sum_{i=1}^{\infty} d_i x_{t-i} + v_{2,t},\end{aligned}$$

to study the effects of trade-related information on prices. In the above equation, Δq_t is conventionally defined as the quote change subsequent to the t th trade. Furthermore, the informational component of price variation can be related to two different sources of information, public and private. These informational shocks are commonly represented with two white noise processes $v_{1,t}$ and $v_{2,t}$. Specifically, $v_{1,t}$ is the update to the public information set and $v_{2,t}$ is the update from the private information which is gleaned from unexpected trades. Dufour and Engle (2000) consider the simplest version of this model where x_t is a univariate limited dependent variable, the trade sign. Hasbrouck (1991b) proposes generalizations with x_t as a vector of trade-related variables (e.g., trade sign, the interaction between trade sign and volume, the interaction between trade sign and spread).

price revisions always follow the trading activities. The model allows causality running from lagged price revisions to trading volumes but not contemporaneously^c.

Following the above discussion, we use a similar framework of the extended VEC model by Arranz and Escribano (2000) with 4 equations, and with $r \leq 3$ co-integrating vectors,

$$F\Delta z_t = \alpha\beta'z_{t-1} + G(L)\Delta z_{t-1} + \xi_t \quad (5)$$

where $\Delta z_t = (\Delta p_t^A, \Delta p_t^B, \Delta x_t^A, \Delta x_t^B)'$ is a 4 x 1 vector.

$$\xi_t' = (\varepsilon_t^A \ \varepsilon_t^B \ e_t^A \ e_t^B),$$

α is a 4 x r matrix of coefficients representing the speed of adjustment to equilibrium,

β is a 4 x r matrix of long-run coefficients,

$$F = \begin{bmatrix} 1 & 0 & -\theta_{A,0}^A & -\theta_{B,0}^A \\ 0 & 1 & -\theta_{A,0}^B & -\theta_{B,0}^B \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix},$$

$$G(L) = \begin{bmatrix} \phi_A^A(L) & \phi_B^A(L) & (\theta_A^A(L) - \theta_{A,0}^A)L^{-1} & (\theta_B^A(L) - \theta_{B,0}^A)L^{-1} \\ \phi_A^B(L) & \phi_B^B(L) & (\theta_A^B(L) - \theta_{A,0}^B)L^{-1} & (\theta_B^B(L) - \theta_{B,0}^B)L^{-1} \\ \Pi_{p,A}^A(L) & \Pi_{p,B}^A(L) & \Pi_{x,A}^A(L) & \Pi_{x,B}^A(L) \\ \Pi_{p,A}^B(L) & \Pi_{p,B}^B(L) & \Pi_{x,A}^B(L) & \Pi_{x,B}^B(L) \end{bmatrix}$$

^c The causality structure is common among theoretical models, such as Huang and Stoll (1997).

The empirical model (5) contains the main features of the structural relationship as described previously. It includes the contemporaneous causality running from trading volumes to prices; lagged causality from prices to trading volumes; uncorrelated (by definition) volume-related and volume-unrelated shocks; multiple co-integration relationships involving trading volumes and prices, and all the relevant information being inferred from the past trading volumes and prices.^a

The Model of Information Shares

Hasbrouck (1991a, 1995) proposes a measure of a market's contribution to price discovery based on the permanent impact of new information on observed prices. This study extends it to calculate "information

shares" as relative contributions of variance of a security in the variance of innovations of both trading volumes and prices. The modified information share (MIS) model can effectively distinguish the information asymmetry resulting from private information or public information. Every VEC model has an associated common trend model representation implied by the co-integration relationships^b. The vector moving average (VMA) representation of (5) is

$$\Delta z_t = \Psi(L)\xi_t \quad (6)$$

^a A salient feature of the VEC model (equation (5)) is the extra lags in the error correction term. This type of specification is called an extended vector error correction (EVEC) model.

^b Hasbrouck (2002) confronts the information share approach in Hasbrouck (1995) with the permanent-transitory approach in Harris et al. (2002). He shows that in the case of a two-market model with private and public information, similar to the one presented in this paper, the information share approach is more reliable. The bound generated by the information share approach contains (up to the estimation error) the true value. This cannot be said for the permanent-transitory approach.

where $\Psi(L)$ is a lag polynomial. Consider the first two equations in (6),

$$\Delta p_t = \psi(L) \xi_t$$

where $\Delta p_t' = (\Delta p_t^A \Delta p_t^B)$ and $\psi(L)$ represents the first two rows in $\Psi(L)$. By recursive substitution and using $\psi(L) = \psi(1) + (1-L)\psi^*(L)$ with $\psi^*(L) = (\psi(L) - \psi(1))(1-L)^{-1}$,

$$p_t = \psi(1) \sum_{\tau=1}^t \xi_\tau + \psi^*(L) \xi_t \quad (7)$$

The first term on the right side of (7) is the common long-run (permanent) component. The second term is a zero-mean weakly stationary (transitory) component. Co-integration entails $\delta' \Psi(1) = 0$, where δ is a co-integration vector. Under the theoretical assumption that the difference between the prices is stationary, $\delta' = (1-100)$ we have that $\psi_1(1) = \psi_2(1)_{(1 \times 4)}$, with $\psi_k(1)$ representing the k th row in $\Psi(1)$. Intuitively, the common long-run component implies that the long-run impact of a new shock on either A or B share should have the same permanent impact on all prices. It follows that $\psi \xi_t$ measures the impact of a shock on the information efficient price.

Let $Var(\xi_t) = \Omega_{(4 \times 4)}$. Then the long-run variance would be given by $\psi \Omega \psi'$. The aim is to identify the part of this long-run variance that is explained by each market's information. Under the assumption of no correlation between (e_t^A, e_t^B) and $(\varepsilon_t^A, \varepsilon_t^B)$, the δ 's corresponding modified information share (MIS) would be

$$MIS^\delta = \frac{\psi_\delta^2 \sigma_\delta^2}{\psi \Omega \psi'} \quad \delta = \{\varepsilon_t^A, \varepsilon_t^B, e_t^A, e_t^B\} \quad (8)$$

where $\psi_\delta^2 \sigma_\delta^2$ and ψ_δ is the δ 's corresponding component of the row vector ψ . Further, it requires that

$$\sum_\delta MIS^\delta = 1 \quad (9)$$

If the innovations in $\xi_t' = (\varepsilon_t^A \varepsilon_t^B e_t^A e_t^B)$ are correlated, the covariance terms in Ω could be attributed to any shock. This paper follows Hasbrouck's suggestion of constructing upper and lower bounds for the information shares. We orthogonalize the residual variance-covariance matrix using the Cholesky factorization and rotate the ordering of the variables to maximize and minimize the explanatory power of each particular shock. The Hasbrouck modeling framework is problematic wherever the contemporaneous correlation of shocks across markets is substantive. In that case, Huang (2002) and Booth et al. (2002) show wide gaps between the upper and lower bounds on the information shares. Although Hasbrouck (1995) indicates the higher the correlation between market innovations, the greater (smaller) the upper (lower) bound, Baillie et al. (2002) shows that the mean value of the lower and upper bounds is a reasonable estimate of a market's contribution to price discovery.

Empirical results

Data

There are two stock exchanges in China, the Shanghai stock exchange and the Shenzhen stock exchange, both inaugurated in the early 1990s. The Shenzhen exchange is a relatively smaller and less liquid market. The market for 13 shares opened in 1992, more than a year after A shares were first listed on the Shanghai exchange. Table 1 presents basic statistics for the two exchanges and Figure 1 plots the daily trading volumes and share indices of A and B shares in the two exchanges.

The sample in this study includes times series of daily closing prices for sixty-four firms issuing both A and B shares from 10/6/1997 to 10/31/2005 on either the Shanghai or Shenzhen stock exchange. Among the firms, thirty-four are from the Shanghai exchange and thirty are from the Shenzhen exchange. We divide the full sample into two sub-periods: before

(10/6/1997 – 2/18/2001) and after (2/20/2001 – 10/31/2005) when China opened B shares to domestic investors.

Since the information-driven component in the information share model is assumed to follow a random walk, which is a unit root process. Thus, we examine whether prices from cross-listing (both A-shares and B-shares) contain unit roots and exclude the samples that do not follow a random walk. In the final sample, there are a total of eight firms in Shanghai and twelve firms in Shenzhen left before China opened B shares to domestic investors and twenty-six firms in Shanghai and twenty-two firms left in Shenzhen after the opening of B shares (see Appendix for the list of company names).

Cointegration between A- and B-shares

In segmented markets, prices are primarily determined by supply and demand conditions within each trading venue. By contrast, proper price discovery requires that prices from various traders not only be informative but that they also reflect common information on the underlying asset. This means prices for the same asset must be cointegrated.

To test the cointegration relationship of prices between A- and B-shares, we adopt the Johansen (1988) maximum likelihood methodology. Johansen (1988) observes that the rank of the matrix $\alpha\beta'$ in (1a) determines whether or not the prices from various markets are cointegrated, and rank also determines the number of cointegrating vectors. Specifically, he provides two test statistics:

$$\lambda_{trace}(r) = -T \sum_{t=r+1}^n \ln(1 - \hat{\lambda}_t) \quad (10)$$

and

$$\lambda_{max}(r, r+1) = -T \ln(1 - \hat{\lambda}_{r+1}) \quad (11)$$

where the n characteristic roots are ordered such that $\lambda_1 > \lambda_2 > \dots > \lambda_n$ and T is the number of observations. The statistic λ_{trace} tests the null hypothesis that the number of cointegrating vectors is less than or equal to r against the alternative that it is greater

than r . The statistic λ_{max} tests the null hypothesis that the number of cointegrating vectors equals r against the alternative that it is equal to $r+1$.

The test results for all stocks in the final sample in each of the two exchanges are consistent with at least one cointegrating vector. Tables 2(a) and 2(b) report the cointegration results for the sample period before and after the opening of B-shares. The results for the two exchanges are similar.

The Information Shares of Hasbrouck (1995)

The estimation methodology exploits the duality between the VAR representation (5) and the VMA formulation (7) to estimate the information share, using the covariance matrix of innovations diagonalized by the Cholesky factorization procedure. Varying the participant order produces the maximum and minimum bounds on the information shares of the participants. Since an estimate of the information share's standard error is difficult to obtain, the analysis follows Hasbrouck (1995) in using the cross-sectional variation in the information share to determine the statistical significance of the estimates.

Tables 3(a) and 3(b) report the information shares in Shanghai and Shenzhen exchanges respectively. The two exchanges have similar results. Before the opening of B-shares to domestic investors, B-shares dominate the market (with an average of 61.88 percent (55.72 percent) in B-shares as compared to 38.12 percent (44.28 percent in A-shares in Shanghai (Shenzhen)). However, A-shares dominate the market after the opening of B-shares to domestic investors (with an average of 58.01 percent (54.52 percent) in A-shares compared to 41.99 percent (45.48 percent) in Shanghai (Shenzhen)).

The result before the opening of B-shares is consistent with the "institutional dominance hypothesis," in which large foreign institutional investors generally are more experienced, have better means of obtaining

information, and have access to more advanced technology to analyze the data. In the earlier period when A- and B-shares were completely segmented, the B-share market was traded by foreign institutional investors only. The A-share market, composed of domestic individual investors, learned information from the B-share market. However, after the opening of B-shares to domestic investors, traders in the B-share market are composed of both foreign institutional investors and domestic investors. The information advantage of B-shares thus no longer exists.

Despite using different empirical models, our finding is consistent with those of Chui and Kwok (1998) and Sjö and Zhang (2000). They all indicate there exists crucial information barriers to domestic investors in China, mainly because of the low creditability of the domestic media. The cost of obtaining correct information about the stock market is generally high for domestic investors. Thus, a cost-effective way for getting information is to observe the price movements in the foreign B shares.

The information asymmetry is obvious in Shanghai relative to that in Shenzhen. The explanation could be that the Shenzhen exchange is relatively smaller in terms of total market capitalization and the number of listed firms (as shown in Table 1)^c. The finding is also at odds with the argument that the Shenzhen market informationally leads the Shanghai market, as reported in Fung et al. (2000) and Poon and Fung (2000). The observed prices and trading activities in the Shanghai exchange seem to play a more important role as a “buy signal” for relatively uninformed domestic investors^d.

^c Another possible explanation is that more “foreign” investors (mainly Hong Kong investors, who are allowed to open A-share accounts in Shenzhen and Shanghai) traded A-share in Shenzhen than that in Shanghai before February 2001.

^d Another possible explanation is information quality and institutional investor choices. Chan (1993) argues large firm has better quality information than small firms. Thus, institutional investors usually

The Modified Information Shares

Table 4(a) (Table 4(b)) represents the lower, upper and mean modified information shares bounds between A and B shares on the Shanghai (Shenzhen) exchange. Table 4(c) summarizes the average mean values of modified information shares between A and B shares. As shown in Table 4(c), the private (volume-related) information shocks (in e^A and e^B) always dominate the public (volume-unrelated) information shocks (in ε^A and ε^B) on both exchanges. Before the opening of B-shares to domestic investors, B-shares’ contribution is slightly higher than A-shares’ in private information shocks. As for public information shocks, B-shares’ price discovery contribution is slightly lower than A-shares’. The two exchanges have similar findings.

When the market is completely segmented, the results in this section support the institutional dominance hypothesis. Even though the B-share market has relatively low trading volumes (as shown in Figure 2), foreign institution investors, who have been regarded as informed traders^e, have better private information than local investors because of their experience and expertise. By contrast, local individual investors’ information advantage on public information is due to their understanding of the local language and culture. Another potential source of information advantage for local investors is a better knowledge of important government data releases or policy actions (Covrig and Melvin (2002)). After the opening of B-shares to domestic investors, A-shares have an information advantage over B-shares in both private and public information shocks (except for the

focus on large firms. Individual investors adjust the prices of small stocks after observing previous price changes of large stocks. Bailey and Jagtiani (1994) found that foreign investors prefer to invest in large domestic firms where the financial disclosure and information availability are better.

^e Many prior studies, such as Szewczyk et al. (1992), Alangar et al. (1999), Chakravarty (2001) and Anand et al. (2005), found evidence of institutions being better informed (relative to individuals).

public information in the Shenzhen exchange). The result, which supports the local familiarity hypothesis, is consistent with the finding by Chiu et al. (2005). They indicated that the removal of the B-share restriction accelerates the market integration between A- and B-shares.

Conclusion

Are foreign investors at an information advantage (or disadvantage) relative to domestic investors? This has been one of the frequently researched topics in the international capital market literature. This paper examines the possible information asymmetry between A-share (domestic investors) and B-share (foreign investors) markets in China. China's stock market is an ideal market for investigation since the A-share and B-share markets were completely segmented before February 19, 2001, which means that we can examine information advantages of A- and B-share markets under different trading mechanisms. Foreign investors in the B-share market are almost all institutional investors who are more experienced and have better means of obtaining information. By contrast, domestic investors in the A-share market are almost all individual investors who rely

solely on rumor and perception and are more likely to trade based on “noise” rather than on information.

We use and modify the Hasbrouck's information share model to analyze the contribution of each market to price discovery. The modified information share model allows us to distinguish two sources of information asymmetries between markets: volume-related (private) information shocks and volume-unrelated (public) information shocks.

The empirical results indicate that when the two markets are completely segmented, the price discovery contribution of B-shares is slightly higher (lower) than that of A-shares in private (public) information shocks. This implies that domestic individual investors have better public information, while foreign institutional investors have better private information. After the B-share market was opened to domestic investors, the information advantage of B-shares no longer exists. Due to the improvement of market integration between A- and B-shares, the A-share market has the information advantage over the B-share market in both private and public information shocks.

Table 1 Descriptive statistics^a

	Shanghai stock exchange	Shenzhen stock exchange
Number of A shares listed	824	54
Number of B shares listed	534	55
A-share market capitalization (billion RMB) ^b	490.592	199.562
B-share market capitalization (billion RMB)	10.445	12.639

^a This table contains basic statistics of China's stock markets during the sample period in the study.

^b Updated to October, 2005.

Table 2(a) Cointegration Tests Before the Opening of B-shares

The table presents the results of Johansen cointegration tests for daily closing prices between A- and B-shares on twenty cross-listed stocks (eight in Shanghai and twelve in Shenzhen) before the opening of B-shares to domestic investors. Two test statistics are λ_{trace} and λ_{max} and the critical values are from Osterwald-Lenum (1992). The statistic λ_{trace} tests the null hypothesis that the number of cointegrating vectors is less than or equal $r = 1$ against the alternative that it is greater than r . The statistic λ_{max} tests the null hypothesis that the number of cointegrating vectors equals r against the alternative that it is equal to $r + 1$.

Shanghai (8 firms)				Shenzhen (12 firms)			
Code no. of stock	λ_{trace}	λ_{max}	critical values	Code no. of stock	λ_{trace}	λ_{max}	critical values
600614	25.677	23.295	2.382	000002	18.399	16.544	1.854
600639	25.779	24.375	1.405	000011	21.533	19.155	2.378
600663	24.403	19.152	5.251	000016	25.428	22.259	3.169
600680	21.083	19.202	1.881	000018	24.867	20.218	4.649
600776	22.263	19.808	2.456	000026	15.361	15.361	0.000
600801	19.480	18.401	1.079	000056	18.073	15.839	2.234
600822	19.132	16.930	2.202	000058	12.047	11.814	0.233
600841	22.661	20.933	1.728	000418	40.264	32.373	7.892
				000530	30.009	23.325	6.685
				000539	17.101	15.980	1.122
				000541	34.597	29.882	4.716
				000553	11.971	11.971	0.000

Table 2(b) Cointegration Tests After the Opening of B-shares

The table presents the results of Johansen cointegration tests for daily closing prices between A- and B-shares on forty-eight cross-listed stocks (twenty-six in Shanghai and twenty-two in Shenzhen) after the opening of B-shares to domestic investors. Two test statistics are λ_{trace} and λ_{max} and the critical values are from Osterwald-Lenum (1992). The statistic λ_{trace} tests the null hypothesis that the number of cointegrating vectors is less than or equal $r = 1$ against the alternative that it is greater than r . The statistic λ_{max} tests the null hypothesis that the number of cointegrating vectors equals r against the alternative that it is equal to $r = 1$.

Shanghai (26 firms)				Shenzhen (22 firms)			
Code no. of stock	λ_{trace}	λ_{max}	critical values	Code no. of stock	λ_{trace}	λ_{max}	critical values
600054	38.143	35.917	2.226	000002	22.716	19.667	3.049
600094	35.802	32.029	3.772	000011	54.066	51.516	0.002
600190	57.229	54.247	2.982	000012	15.373	13.416	1.957
600221	63.093	59.837	3.256	000016	12.942	10.089	2.854
600604	43.016	41.089	1.927	000018	24.929	22.889	2.040
600610	26.311	24.911	1.400	000019	27.492	25.800	1.692
600611	32.623	30.881	1.742	000022	28.826	24.665	4.160
600612	51.528	49.702	1.827	000024	15.464	15.423	0.041
600613	35.180	33.525	1.655	000028	38.512	33.902	4.610
600614	47.547	44.591	2.955	000055	25.057	23.910	1.146
600619	38.755	36.755	2.000	000058	21.505	19.620	1.885
600639	22.864	21.033	1.830	000413	17.665	15.706	1.958
600648	35.650	33.441	2.209	000429	39.671	34.675	4.995
600650	39.536	36.562	2.975	000513	30.750	29.341	1.409
600663	12.856	10.952	1.904	000521	56.549	53.627	2.922
600680	41.954	39.891	2.062	000530	14.699	12.915	1.785
600689	49.246	46.739	2.507	000550	28.806	28.347	0.460
600726	35.807	32.481	3.326	000553	19.782	18.068	1.714
600754	38.218	35.339	2.879	000570	65.307	61.546	3.762
600776	41.231	34.642	6.589	000581	17.019	16.479	0.540
600801	35.437	33.231	2.206	000625	15.145	14.426	0.719
600822	23.671	22.339	1.331	000761	36.650	33.033	3.618
600827	26.619	25.059	1.560				
600835	19.732	17.828	1.904				
600843	26.881	25.041	1.840				
600845	30.780	28.937	1.842				

Table 3(a) Hasbrouck's Information Shares in Shanghai Exchange

This table reports estimates (by percentage) of the Hasbrouck's (1995) information shares (as described in Section 3) for A- and B-shares in Shanghai before and after the opening of B-shares to domestic investors. It includes upper bounds, lower bounds, and mean values of information shares. The averages of the above upper bounds, lower bounds, and mean values of all A-share and B-share stocks (eight firms before and twenty-six firms after the opening of B-shares) are listed on the bottom line.

Unit: %

Code no. of stocks	Before the opening (8 firms)						After the opening (26 firms)					
	A-shares			B-shares			A-shares			B-shares		
	upper	lower	mean	upper	lower	mean	upper	lower	mean	upper	lower	mean
600054							93.86	14.28	54.07	85.72	6.14	45.93
600094							97.29	17.68	57.48	82.32	2.71	42.52
600190							96.92	26.81	61.86	73.19	3.08	38.14
600221							99.85	26.09	62.97	73.91	0.15	37.03
600602												
600604							98.80	15.09	56.94	84.91	1.20	43.06
600610							98.21	16.71	57.46	83.29	1.79	42.54
600611							96.75	24.87	60.81	75.13	3.25	39.19
600612							97.53	19.32	58.42	80.68	2.47	41.58
600613							95.50	8.67	52.09	91.33	4.50	47.91
600614	64.75	26.24	45.50	73.36	35.25	54.50	93.64	26.74	60.19	73.26	6.36	39.81
600618												
600619							93.26	11.37	52.32	88.63	6.74	47.68
600623												
600639	47.76	5.51	26.64	94.49	52.24	73.36	97.94	14.95	56.45	85.05	2.06	43.55
600648							96.95	15.33	56.14	84.67	3.05	43.86
600650							99.53	23.28	61.41	76.72	0.47	38.59
600663	35.68	3.26	19.47	64.32	96.74	80.53	98.64	19.13	58.88	80.87	1.36	41.12
600679												
600680	80.02	29.50	54.76	70.5-	19.98	45.24	97.27	14.71	55.99	85.29	2.73	44.01
600689							95.09	10.20	52.65	89.80	4.91	47.35
600726							99.10	24.77	61.93	75.23	0.90	38.07
600754							96.84	17.34	57.09	82.66	3.16	42.91
600776	29.61	1.04	15.32	98.96	70.39	84.68	99.43	16.05	57.74	83.95	0.57	42.26
600801	66.99	20.18	43.58	79.82	33.01	56.42	98.38	29.90	64.14	70.10	1.62	35.86
600818												
600822	80.51	39.01	59.76	60.99	19.49	40.24	95.58	15.18	55.38	84.82	4.42	44.62
600827							99.93	46.05	72.99	53.95	0.07	27.01
600835							99.67	28.93	64.30	71.07	0.33	35.70
600841	63.95	15.93	39.94	84.07	36.05	60.06						
600843							94.24	9.48	51.86	90.52	5.76	48.14
600845							87.27	6.23	46.75	93.77	12.73	53.25
Average			38.12			61.88			58.01			41.99

Table 3(b) Hasbrouck's Information Shares in Shenzhen Exchange

This table reports estimates (by percentage) of the Hasbrouck's (1995) information shares (as described in Section 3) for A- and B-shares in Shenzhen before and after the opening of B-shares to domestic investors. It includes upper bounds, lower bounds, and mean values of information shares. The averages of the above upper bounds, lower bounds, and mean values of all A-share and B-share stocks (twelve firms before and twenty-two firms after the opening of B-shares) are listed on the bottom line.

Unit: %

Code no. of stocks	Before the opening (12 firms)						After the opening (22 firms)					
	A-shares			B-shares			A-shares			B-shares		
	upper	lower	mean	upper	lower	mean	upper	lower	mean	upper	lower	mean
000002	61.57	7.14	34.36	92.86	38.43	65.64	82.08	2.59	42.33	97.41	17.92	57.67
000011	89.68	23.32	56.50	76.68	10.32	43.50	98.56	7.25	52.91	1.44	92.75	47.09
000012							99.19	27.57	63.38	72.43	0.81	36.62
000016	70.42	29.23	49.83	70.77	29.58	50.17	89.13	31.56	60.35	68.44	10.87	39.65
000018	99.49	81.81	90.65	18.19	0.51	9.35	97.02	10.52	53.77	89.48	2.98	46.23
000019							98.13	10.48	54.30	89.52	1.87	45.70
000022							88.64	7.33	47.99	92.67	11.36	52.01
000024							96.83	16.35	56.59	83.65	3.17	43.41
000026	59.76	11.92	35.84	80.08	40.24	64.16						
000028							99.77	18.19	58.98	81.81	0.23	41.02
000029												
000037												
000039												
000045												
000055							87.76	0.17	43.97	99.83	12.24	56.03
000056	73.35	23.62	48.49	76.38	26.65	51.51						
000058	85.80	33.64	59.72	66.36	14.20	40.28	97.21	10.25	53.73	89.75	2.79	46.27
000413							90.97	3.24	47.11	96.76	9.03	52.89
000418	30.52	4.99	17.76	95.01	69.48	82.24						
000429							96.13	13.38	54.76	86.62	3.87	45.24
000513							99.33	18.18	58.76	81.82	0.67	41.24
000521							99.99	17.41	58.70	82.59	0.01	41.30
000530	35.15	0.16	17.66	99.84	64.85	82.34	99.83	20.60	60.21	79.40	0.17	39.79
000539	74.54	14.79	44.66	85.21	25.46	55.34						
000541	24.23	0.31	12.27	99.69	75.77	87.73						
000550							98.14	25.74	61.94	74.26	1.86	38.06
000553	91.57	35.77	63.67	64.23	8.43	36.33	88.77	3.67	46.22	96.33	11.23	53.78
000570							99.71	14.34	57.03	85.66	0.29	42.97
000581							99.68	29.28	64.46	70.77	0.32	35.54
000625							64.54	27.95	46.24	72.05	35.46	53.76
000761							97.02	14.40	55.71	2.98	85.60	44.29
Average			44.28			55.72			54.52			45.48

Table 4(a) Modified Information Shares between A-shares and B-shares on the Shanghai Exchange

This table reports estimates (by percentage) of the modified information shares (as described by equation (8)) for A- and B-shares in Shanghai before (panel A) and after (panel B) the opening of B-shares to domestic investors. It includes upper bounds, lower bounds, and mean values of modified information shares for public information in A-shares (\mathcal{E}^A), B-shares (\mathcal{E}^B) and private information in A-shares (e^A), B-shares (e^B).

Panel A: the first subperiod (before the opening)

Unit: %

Panel A: the first subperiod (before the opening)				Unit: %					
Code no. of stocks	upper	lower	mean	Code no. of stocks	upper	lower	mean		
600614	\mathcal{E}^A	27.03	0.12	9.74	600776	\mathcal{E}^A	20.38	0.00	20.71
	\mathcal{E}^B	11.53	0.01	3.22		\mathcal{E}^B	7.82	0.00	4.27
	e^A	95.78	9.07	56.75		e^A	79.90	20.71	44.28
	e^B	86.63	2.38	30.29		e^B	63.63	9.70	43.46
600639	\mathcal{E}^A	20.68	0.01	8.43	600801	\mathcal{E}^A	37.98	0.30	13.97
	\mathcal{E}^B	4.55	0.01	1.65		\mathcal{E}^B	25.13	0.00	5.79
	e^A	75.85	8.98	36.95		e^A	96.01	7.04	50.07
	e^B	85.42	22.01	52.98		e^B	80.48	2.21	30.17
600663	\mathcal{E}^A	25.33	0.04	7.00	600822	\mathcal{E}^A	3.07	0.07	1.36
	\mathcal{E}^B	22.00	0.00	6.86		\mathcal{E}^B	6.12	0.00	1.71
	e^A	87.48	0.53	31.46		e^A	92.70	1.60	46.37
	e^B	86.76	7.30	54.68		e^B	97.37	5.96	50.56
600680	\mathcal{E}^A	16.11	0.19	6.35	600841	\mathcal{E}^A	16.69	0.10	7.08
	\mathcal{E}^B	11.17	0.00	3.40		\mathcal{E}^B	8.33	0.01	2.75
	e^A	85.91	2.99	39.25		e^A	76.53	7.41	39.09
	e^B	92.47	12.55	51.01		e^B	86.75	21.43	51.08

Panel B: the second subperiod (after the opening)

after the first suspension (after the opening)				after the second suspension (after the opening)					
Code no. of stocks		upper	lower	mean	Code no. of stocks		upper	lower	mean
600654	\mathcal{E}^A	9.97	0.11	3.36	600650	\mathcal{E}^A	5.51	0.05	1.57
	\mathcal{E}^B	42.32	0.00	6.32		\mathcal{E}^B	15.23	0.00	3.17
	e^A	90.70	3.43	54.41		e^A	97.08	0.21	63.21
	e^B	94.40	1.78	35.92		e^B	97.83	1.04	32.05
600694	\mathcal{E}^A	8.71	0.02	2.32	600663	\mathcal{E}^A	98.16	19.44	60.82
	\mathcal{E}^B	10.27	0.01	2.78		\mathcal{E}^B	78.98	0.92	33.79
	e^A	80.62	1.02	34.39		e^A	15.55	0.00	4.55
	e^B	95.68	17.55	60.50		e^B	3.78	0.12	0.84
600190	\mathcal{E}^A	42.94	0.21	12.53	600680	\mathcal{E}^A	3.73	0.00	1.43
	\mathcal{E}^B	40.96	0.00	7.84		\mathcal{E}^B	21.93	0.00	2.39
	e^A	98.19	0.03	45.47		e^A	92.48	0.40	62.62
	e^B	98.57	0.24	34.16		e^B	95.60	4.52	33.56
600221	\mathcal{E}^A	95.60	0.34	29.30	600689	\mathcal{E}^A	25.01	0.00	7.25
	\mathcal{E}^B	67.61	0.00	13.14		\mathcal{E}^B	13.86	0.00	3.70
	e^A	98.62	0.02	34.72		e^A	89.71	0.97	41.40
	e^B	98.01	0.01	22.83		e^B	97.36	8.68	47.65
600604	\mathcal{E}^A	8.46	0.01	2.28	600726	\mathcal{E}^A	21.77	0.15	7.34
	\mathcal{E}^B	18.24	0.01	3.28		\mathcal{E}^B	13.71	0.00	3.18
	\mathcal{E}^B	96.44	0.62	42.05		\mathcal{E}^B	92.88	0.45	39.74

	e^A	97.51	1.97	52.39		e^A	98.52	6.21	49.74
	e^B					e^B			
600610	\mathcal{E}^A	96.14	27.21	69.49	600754	\mathcal{E}^A	28.83	0.24	8.69
	\mathcal{E}^B	70.33	0.01	21.15		\mathcal{E}^B	24.85	0.00	5.93
	e^A	18.98	0.00	7.04		e^A	98.00	0.23	49.39
	e^B	6.80	0.72	2.32		e^B	98.26	1.05	35.99
600611	\mathcal{E}^A	16.43	0.25	5.21	600776	\mathcal{E}^A	54.15	0.29	15.70
	\mathcal{E}^B	14.13	0.00	3.19		\mathcal{E}^B	46.84	0.00	9.15
	e^A	95.10	0.12	37.24		e^A	95.42	0.15	36.64
	e^B	98.59	3.88	54.36		e^B	96.30	1.89	38.50
600612	\mathcal{E}^A	10.06	0.00	3.10	600801	\mathcal{E}^A	12.54	0.33	3.63
	\mathcal{E}^B	4.87	0.00	1.92		\mathcal{E}^B	17.89	0.00	4.61
	e^A	93.17	20.68	58.05		e^A	83.29	0.02	36.94
	e^B	77.15	2.76	36.93		e^B	98.78	14.30	54.82
600613	\mathcal{E}^A	86.30	0.32	10.71	600822	\mathcal{E}^A	13.65	0.41	2.95
	\mathcal{E}^B	85.00	0.00	8.94		\mathcal{E}^B	23.89	0.00	4.52
	e^A	81.24	0.95	34.27		e^A	98.58	0.24	63.20
	e^B	90.97	0.04	46.08		e^B	98.32	0.07	29.33
600614	\mathcal{E}^A	9.30	0.32	2.95	600827	\mathcal{E}^A	60.19	0.61	21.64
	\mathcal{E}^B	11.38	0.00	2.69		\mathcal{E}^B	24.02	0.00	4.65
	e^A	95.10	5.66	60.09		e^A	98.86	0.20	40.38
	e^B	91.83	0.90	34.27		e^B	90.54	0.18	33.33
600619	\mathcal{E}^A	36.35	0.04	9.24	600835	\mathcal{E}^A	9.93	0.10	2.09
	\mathcal{E}^B	27.48	0.00	8.60		\mathcal{E}^B	20.80	0.00	2.49
	e^A	85.51	0.00	32.38		e^A	99.07	7.40	76.72
	e^B	91.19	9.70	49.77		e^B	82.61	0.15	18.70
600639	\mathcal{E}^A	5.20	0.09	1.36	600843	\mathcal{E}^A	5.79	0.03	1.63
	\mathcal{E}^B	16.50	0.00	1.73		\mathcal{E}^B	16.58	0.01	2.08
	e^A	90.68	0.41	57.08		e^A	98.75	9.19	71.49
	e^B	98.05	7.38	39.83		e^B	86.32	1.14	24.80
600648	\mathcal{E}^A	3.85	0.01	1.36	600845	\mathcal{E}^A	2.26	0.01	0.79
	\mathcal{E}^B	15.89	0.00	1.78		\mathcal{E}^B	15.70	0.00	2.02
	e^A	87.30	0.20	56.53		e^A	97.91	0.06	65.37
	e^B	98.23	10.25	40.33		e^B	98.25	0.94	31.82

Table 4(b) Modified Information Shares between A-shares and B-shares in the Shenzhen Exchange
 This table reports estimates (by percentage) of the modified information shares (as described by equation (8)) for A- and B-shares in Shenzhen before (panel A) and after (panel B) the opening of B-shares to domestic investors. It includes upper bounds, lower bounds, and mean values of modified information shares for public information in A-shares (\mathcal{E}^A), B-shares (\mathcal{E}^B) and private information in A-shares (e^A), B-shares (e^B).

Panel A: the first subperiod (before the opening)

Unit: %

Panel A: the first subperiod (before the opening)				Panel B: the second subperiod (after the opening)					
Code no. of stocks	upper	lower	mean	Code no. of stocks	upper	lower	mean		
000002	\mathcal{E}^A	27.17	0.02	9.54	000058	\mathcal{E}^A	13.78	0.29	5.59
	\mathcal{E}^B	6.00	0.03	1.65		\mathcal{E}^B	5.30	0.00	1.49
	e^A	86.86	7.09	40.51		e^A	87.54	0.67	52.31
	e^B	88.68	11.96	48.30		e^B	97.80	11.16	40.60
000011	\mathcal{E}^A	11.25	0.17	4.20	000418	\mathcal{E}^A	56.21	0.61	22.16
	\mathcal{E}^B	5.69	0.00	1.57		\mathcal{E}^B	17.52	0.00	3.12
	e^A	56.23	0.27	21.56		e^A	98.30	0.13	39.35
	e^B	99.46	42.02	72.67		e^B	95.21	35.37	0.83
000016	\mathcal{E}^A	23.47	0.23	9.73	000530	\mathcal{E}^A	13.74	0.00	4.32
	\mathcal{E}^B	8.32	0.04	2.16		\mathcal{E}^B	11.17	0.01	4.13
	e^A	97.61	24.68	68.76		e^A	63.63	5.79	31.39
	e^B	66.53	1.09	19.35		e^B	91.48	32.50	60.16
000018	\mathcal{E}^A	32.77	1.56	10.90	000539	\mathcal{E}^A	14.45	0.08	5.86
	\mathcal{E}^B	16.81	0.00	3.71		\mathcal{E}^B	6.86	0.02	2.14
	e^A	88.17	0.12	34.56		e^A	76.31	9.64	41.18
	e^B	93.26	8.87	50.84		e^B	86.14	22.44	50.81
000026	\mathcal{E}^A	20.23	0.13	6.62	000541	\mathcal{E}^A	82.33	0.59	32.1
	\mathcal{E}^B	17.36	0.00	5.22		\mathcal{E}^B	12.41	0.00	7.21
	e^A	79.45	0.04	28.21		e^A	80.11	0.00	43.70
	e^B	97.97	16.95	59.96		e^B	47.01	0.21	16.90
000056	\mathcal{E}^A	40.43	0.15	15.36	000553	\mathcal{E}^A	20.90	0.47	8.22
	\mathcal{E}^B	9.95	0.00	2.13		\mathcal{E}^B	10.27	0.00	2.28
	e^A	97.56	0.05	52.55		e^A	91.64	0.13	34.77
	e^B	98.45	1.89	29.97		e^B	97.22	7.43	54.74

Panel B: the second subperiod (after the opening)

Panel B: the second subperiod (after the opening)									
Code no. of stocks	upper	lower	mean	Code no. of stocks	upper	lower	mean		
000002	\mathcal{E}^A	2.73	0.17	0.92	000413	\mathcal{E}^A	11.11	0.00	2.62
	\mathcal{E}^B	21.28	0.03	7.92		\mathcal{E}^B	26.24	0.01	3.92
	e^A	98.78	7.46	62.36		e^A	88.58	4.63	45.06
	e^B	90.86	0.03	28.81		e^B	90.08	8.32	48.40
000011	\mathcal{E}^A	36.60	0.32	10.05	000429	\mathcal{E}^A	25.45	0.00	6.85
	\mathcal{E}^B	45.82	0.00	11.74		\mathcal{E}^B	20.02	0.00	5.74
	e^A	93.79	0.15	33.09		e^A	89.28	0.00	34.98
	e^B	98.26	1.46	45.12		e^B	99.34	8.85	52.43
000012	\mathcal{E}^A	72.92	0.61	21.48	000513	\mathcal{E}^A	6.77	0.16	1.62
		63.30	0.00	12.92			30.68	0.01	8.74
	\mathcal{E}^B	95.85	0.37	31.79		\mathcal{E}^B	96.92	48.61	77.15

	e^A	95.84	1.31	33.81		e^A	46.75	2.10	12.49
	e^B					e^B			
000016	\mathcal{E}^A	31.93	0.96	12.12	000521	\mathcal{E}^A	23.30	0.12	6.51
	\mathcal{E}^B	13.56	0.00	4.02		\mathcal{E}^B	35.08	0.00	7.82
	e^A	98.39	0.22	52.52		e^A	75.36	0.52	31.07
	e^B	96.41	0.00	31.34		e^B	97.17	16.51	54.61
000018	\mathcal{E}^A	5.80	0.65	2.80	000530	\mathcal{E}^A	20.45	0.26	5.24
	\mathcal{E}^B	8.99	0.00	2.15		\mathcal{E}^B	27.09	0.00	5.89
	e^A	72.90	0.00	39.39		e^A	95.71	0.96	34.37
	e^B	94.25	23.35	55.66		e^B	94.06	3.58	54.50
000019	\mathcal{E}^A	3.93	0.04	1.69	000550	\mathcal{E}^A	18.39	0.16	5.85
	\mathcal{E}^B	50.93	0.00	16.69		\mathcal{E}^B	27.98	0.00	6.91
	e^A	80.12	0.03	22.28		e^A	4.12	0.25	30.91
	e^B	97.60	18.67	59.34		e^B	96.25	21.17	56.34
000022	\mathcal{E}^A	19.87	0.28	9.01	000553	\mathcal{E}^A	25.25	0.28	7.07
	\mathcal{E}^B	27.22	0.00	8.93		\mathcal{E}^B	36.08	0.00	8.99
	e^A	48.34	0.05	27.22		e^A	97.38	0.10	42.08
	e^B	92.37	28.53	54.84		e^B	97.71	0.34	41.86
000024	\mathcal{E}^A	12.24	0.12	3.47	000570	\mathcal{E}^A	11.90	0.07	3.79
	\mathcal{E}^B	29.23	0.01	8.22		\mathcal{E}^B	48.71	0.03	12.89
	e^A	97.17	13.49	70.53		e^A	99.85	10.97	61.11
	e^B	81.30	0.39	17.78		e^B	86.99	0.05	22.21
000028	\mathcal{E}^A	3.19	0.03	1.48	000581	\mathcal{E}^A	8.37	0.33	3.40
	\mathcal{E}^B	14.60	0.00	3.34		\mathcal{E}^B	9.15	0.00	2.40
	e^A	88.21	0.71	53.28		e^A	79.28	0.00	41.21
	e^B	97.74	9.01	41.90		e^B	98.61	18.01	52.99
000055	\mathcal{E}^A	54.60	0.32	15.21	00625	\mathcal{E}^A	35.05	0.34	11.05
	\mathcal{E}^B	48.83	0.00	10.71		\mathcal{E}^B	32.31	0.00	6.52
	e^A	97.25	1.91	45.49		e^A	98.35	2.03	53.80
	e^B	92.84	0.44	28.58		e^B	93.97	0.00	28.62
000058	\mathcal{E}^A	67.96	0.27	19.67	000761	\mathcal{E}^A	4.57	0.10	1.86
	\mathcal{E}^B	56.73	0.00	10.90		\mathcal{E}^B	52.04	0.00	4.94
	e^A	98.49	0.14	41.85		e^A	96.75	0.05	59.52
	e^B	97.09	0.00	27.55		e^B	97.01	0.92	33.68

Table 4(c) Summary of the Average Mean Values of Modified Information Shares between A-shares and B-shares

This table summarizes the average mean values of the modified information shares in Table 4(a) and (b). It includes the average mean values of the modified information shares for public information in A-shares (ϵ^A), B-shares (ϵ^B) and private information in A-shares (e^A), B-shares (e^B). All estimates are percentages.

Unit: %

		before the opening		after the opening	
		Shanghai	Shenzhen	Shanghai	Shenzhen
public information	ϵ^A	7.74	11.23	11.11	6.99
	ϵ^B	3.71	3.07	6.35	7.83
private information	e^A	43.03	40.74	46.36	45.05
	e^B	45.53	44.97	36.19	40.13

Figure 1(a): Stock index in Shanghai



Figure 1(b): Stock index in Shenzhen

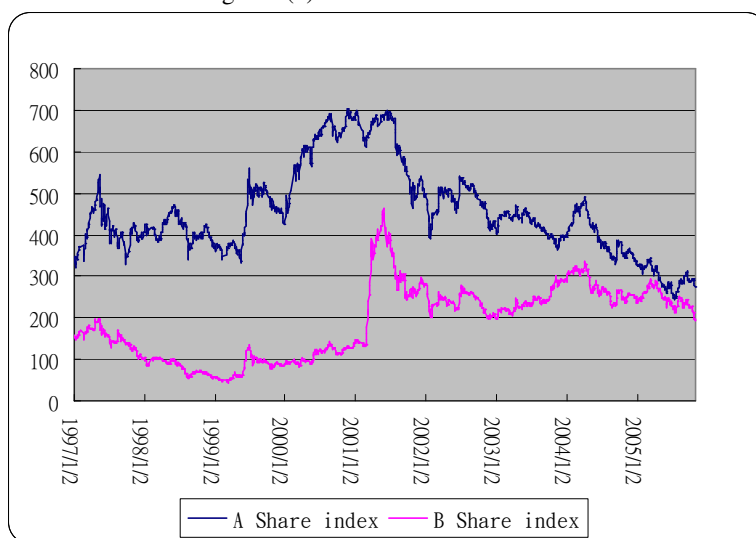


Figure 2(a): Trading volumes in Shanghai

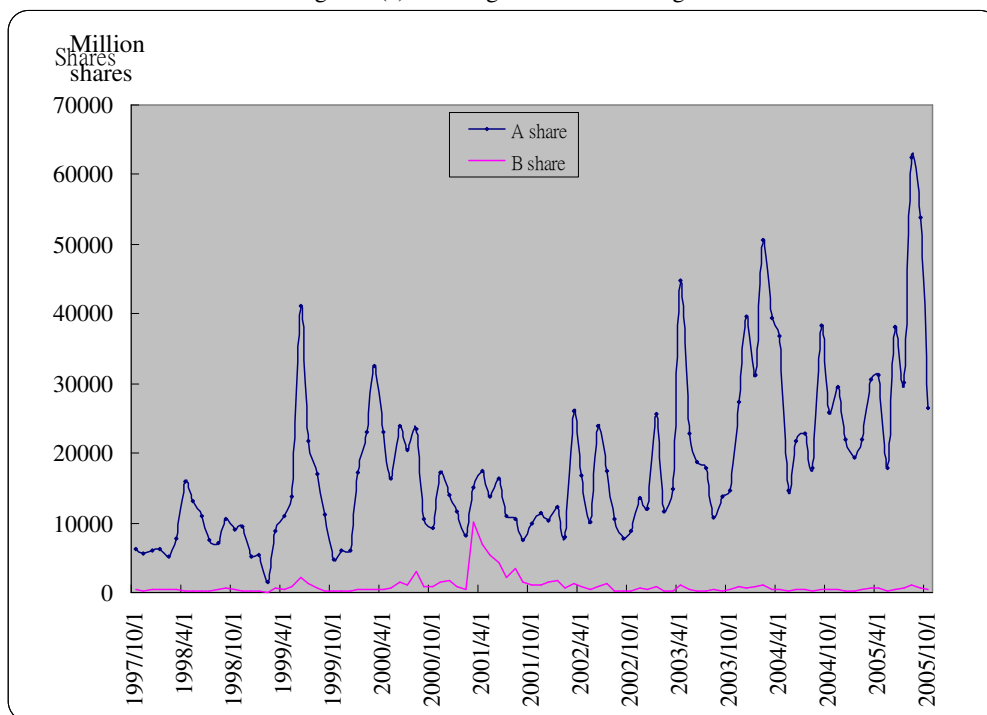
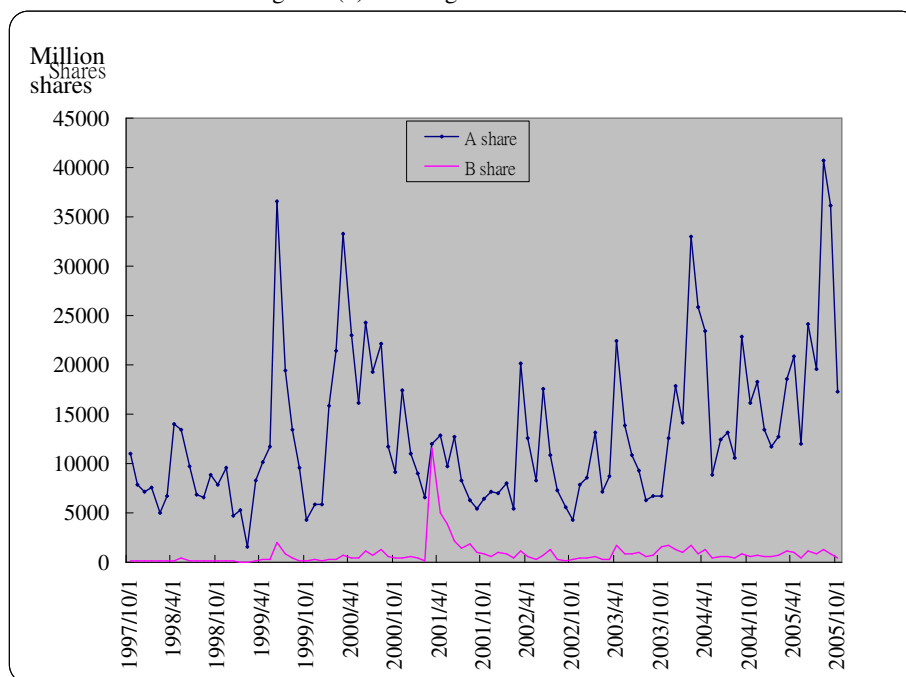


Figure 2(b): Trading volumes in Shenzhen



A. Shanghai Exchange

Code No.	Full name of company
600054	Huangshan Tourism Development Co., Ltd.
600094	Shanghai Worldbest Co., Ltd.
600190	Jinzhou Port Co., Ltd.
600221	Hainan Airlines Co., Ltd.
600602	Sva Electron Co., Ltd.
600604	Shanghai Erfangji Co., Ltd.
600610	China Textile Machinery Co., Ltd.
600611	Dazhong Transportation (Group) Co., Ltd.
600612	China First Pencil Co., Ltd.
600613	Shanghai Wingsung Data Technology Co., Ltd.
600614	Shanghai Sanjiu Technology Development(Group) Co., Ltd.
600618	Shanghai Chlor-Alkali Chemical Co., Ltd.
600619	Shanghai Highly (Group) Co., Ltd.
600623	Shanghai Tyre & Rubber (Group) Co., Ltd.
600639	Shanghai Jinqiao Export Processing Zone Dev. Co., Ltd.
600648	Shanghai Wai Gaoqiao Free Trade Zone Development Co.
600650	Shanghai Jin Jiang International Ind. Inv. Co., Ltd.
600663	Shanghai Lujiazui Finance & Trade Zone Dev. Co., Ltd.
600679	Phoenix Co., Ltd.
600680	Shanghai Posts & Telecommunications Equipment Co., Ltd.
600689	Shanghai Sanmao Enterprise (Group) Co., Ltd.
600726	Huadian Energy Co., Ltd.
600754	Shanghai Jinjiang International Hotels Dev. Co., Ltd.
600776	Eastern Communications Co., Ltd.
600801	Huaxin Cement Co., Ltd.
600822	Shanghai Material Trading Co., Ltd.
600827	Shanghai Friendship Group Incorporated Company
600835	Shanghai Mechanical & Electrical Industry Co., Ltd.
600841	Shanghai Diesel Engine Co., Ltd.
600843	SGSB Group Co., Ltd.
600845	Shanghai Baosight Software Co.,Ltd.

B. Shenzhen Exchange

Code No.	Full name of company
000002	China Vanke Co., Ltd.
000011	Shenzhen Properties & Resources Dev. (Group) Ltd.
000012	CSG Holding Co., Ltd.
000016	Konka Group Co., Ltd.
000018	Shenzhen Victor Onward Textile Ind. Co., Ltd.
000019	Shenzhen Shenbao Industrial Co., Ltd.
000022	Shenzhen Chiwan Wharf Holdings Ltd.
000024	China Merchants Property Development Co., Ltd.
000026	Shenzhen Fiyta Holdings Limited
000028	Shenzhen Accord Pharmaceutical CO., Ltd.
000029	SZ S.E.Z. Real Estate & Properties (Group) Co., Ltd.
000037	Shenzhen Nanshan Power Station Company Limited
000039	China International Marine Containers (Group) Co., Ltd
000045	Shenzhen Textile (Holdings) Co., Ltd.
000055	China Fangda Group Company Limited
000056	Shenzhen International Enterprise Co., Ltd.
000058	Shenzhen SEG Co., Ltd.
000413	Shijiazhuang Baoshi Electronic Glass Company Limited
000418	Wuxi Little Swan Company Limited
000429	Guangdong Provincial Expressway Development Co., Ltd.

Code No.	Full name of company
000513	Livzon Pharmaceutical Group Inc.
000521	Hefei Meiling Co., Ltd.
000530	Dalian Refrigeration Co., Ltd.
000539	Guangdong Electric Power Development Co., Ltd.
000541	Foshan Electrical & Lighting Co., Ltd.
000550	Jiangling Motors Corporation Ltd.
000553	Hubei Sanonda Co., Ltd.
000570	Changchai Co., Ltd.
000581	Weifu High-Technology Co., Ltd.
000625	Chongqing Changan Automobile Co., Ltd.
000761	Bengang Steel Plates Co., Ltd.

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The Asymmetric Information of Alpha on Portfolio Management within the S&P 500

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Abstract

Alpha, Beta and the Sharpe Ratio have become the obsessive Holy Trinity of portfolio management. Portfolio managers are held hostage to these statistics and their benchmark error. This paper recognizes this reality. It is an attempt to help S&P 500 large-capitalization portfolio managers perform better. The hypothesis is that by concentrating only on high alpha stocks, performance characteristics could be enhanced for such managers. The paper makes a compelling case for such conduct.

Introduction

There are many paradigms in finance. One is the contention that the stock market is efficient. Eugene F. Fama espoused this paradigm, The Efficient Market Hypothesis (EMH), while a doctoral student at Chicago. The core concept is simple. Stock prices change from one period to the next due to the appearance of new and unanticipated information. Since this information was revealed randomly, stock prices at all times were correctly set, which is the finance definition of “efficient.” This concept of an efficient market is still paramount in investment theory although strict interpretation of it has been challenged as time has passed. Fama (1970) noted that in an efficient market any new information would be immediately and fully reflected in equity prices.

A financial market therefore quickly, if not instantaneously, discounts all available information. In an efficient market, investors should expect an asset price to reflect its true fundamental value at all times. Bruno Solnik (1996) noted that since fundamental value is unknown, the only way to test for market efficiency is to detect whether some specific news is not yet incorporated in the asset price and could therefore be used to make some abnormal profit.

Those who challenge EMH suggest that there exists public information already available that

can be more effectively incorporated in the asset price and could therefore be used to make some abnormal profit. This group includes most of the world’s investment managers.

Market Efficiency

It is essential to understand the environment in which securities are priced. The signal question is how effectively investor’s expectations are incorporated into security pricing. Are investor’s expectations for a particular security quickly and accurately reflected in the price of the security? This is the concept of market efficiency.

In an efficient market, the current prices of securities represent unbiased estimates of the “fair,” “intrinsic,” “real,” “fair market,” “sound,” and “true” value of the securities. If all securities are correctly valued (by whatever term), investors will earn a return on their investment appropriate for the level of risk assumed by the investor according to Capital Market Theory. This is called the “normal return”. This “normal return” will occur regardless of which securities are purchased. Thus, in a perfectly efficient market in equilibrium all securities are correctly priced, and there are no under or over valued securities. The existing price for each security is its correct price.

The degree to which a market is efficient has a profound implication for investors. If a market is efficient, the time, money, effort, required

knowledge, and anxiety required to engage in security analysis becomes meaningless.

The central theorem of the EMH is that the security market participants are competent and well-informed. It is the competition therefore between these very astute market participants which results in security prices being fairly and correctly priced. These market participants immediately “compete away” any chance to earn an abnormal profit.

The Efficient Market Hypothesis

The framework for a discussion of the Efficient Market Hypothesis (EMH) is generally centered around Eugene Fama’s May 1970 Journal of Finance paper “Efficient Capital Markets: A Review of Theory and Empirical Work.”.

Fama defined efficient markets in terms of a “fair game” where security prices “fully reflect” all the information available. Consequently, if the markets are efficient, individuals can-not consistently receive abnormal risk-adjusted returns. Utilizing the framework of the Capital Asset Pricing Model, this implies that the expected value of ex-ante alpha must be zero. This implies that the complete measurement of risk can be noted in the beta of the security.

Fama suggested that the Efficient Market Hypothesis (EMH) can be divided into three categories. These categories are as follows:

- 1. Weak-Form EMH.** In the weak-form EMH, the type of information being considered is restricted exclusively to historical price data. If the weak-form EMH is correct, investors should not be able to consistently earn abnormal profits by simply observing the historical prices of securities. Weak-Form efficiency is, in fact, a special case of Semi-Strong form efficiency.
- 2. Semi-Strong Form EMH.** The semi-strong form EMH asserts that security prices rapidly and correctly adjust to the release of publicly available information. Thus, under the semi-strong

form, current prices fully reflect not only all past price data but all other data as well. Hence, any and all information that is available to the public should be quickly if not instantaneously reflected in security prices so that investors can not consistently earn abnormal returns by action on such public information.

- 3. Strong-Form EMH.** The strong-form EMH represents the most extreme case of market efficiency. Under the strong-form it is argued that security prices fully reflect all information whether public or private. Fama himself thought that this form was an extreme one that, if ever adequately tested, would prove false.

There are a huge number of empirical studies of the EMH. It is beyond the scope of this paper to conduct even a causal review of those studies. Suffice it to say, researchers have tested the EMH due to its signal importance in financial literature and their combined results indicate that the EMH as postulated by Fama is overwhelmingly supported especially in dealing with the weak and semi-strong versions of the hypothesis. The difficulty of obtaining data on undisclosed sources of information makes it difficult to research the strong-form hypothesis.

However, even in face of this consensus, there are a growing number of researchers that question the EMH. Robert Haugen is one. He argues in multiple books that the EMH is a paradigm that is at the extreme end of the spectrum. He has made a serious case for recognizing that the market overreacts to past records of success and failure with resulting incorrect or imprecise security prices. (Haugen (1999) New Finance p. ix)

Other researchers are even more radical, holding the opinion that the market is in chaos (which also implies you can not beat the index as well).

Finally, there is a small but growing group that believes the American stock market is now

(perhaps again) manipulated. Further, the EMH can also be seriously questioned in view of the international financial turmoil following the sub-prime crisis in the USA.

Alpha

This paper is focused on one aspect of the CAPM spectrum: the Alpha. The alpha herein discussed is the intercept of the regressed returns of a stock and its index—its characteristic line. It represents the unexplained return (positive or negative) given the slope (beta) of the regression against an index such as a capitalization-weighted S&P 500 which is used in this study.

The purpose of this paper is to determine the advantage, if any, of utilizing alpha as a **predictive** factor in portfolio management. CAPM states that beta has predictive powers due to its “memory.” Does alpha have memory power as well?

In portfolio management alpha has assumed a paramount position in measuring portfolio performance. To a great degree, the success of portfolio managers is measured by their risk-adjusted excess returns versus the market. An alpha is then a measurement of the ability to select winning (losing) stocks.

This is part due to the fact that for beta to be valid measurement of risk a diversified portfolio of stocks should have an ex-ante alpha of zero. The only measurement of risk therefore is beta. In a world without CAPM, a beta adjusted return would not exist.

Portfolio managers have found it most difficult to outperform the S&P 500 market on a risk-adjusted basis. Stated another way, they have not been able to capture normally positively desired “excess alpha” in their stock selection process.

Perhaps focusing only on stocks that have historically demonstrated “excess returns” might be a possible way to achieve superior performance within the S&P 500. This is the core of the research hypotheses proposed in this paper.

Research Hypotheses

The research hypotheses of this paper are that by sectoring the S&P 500 into Alpha terciles the Top Alpha tercile will outperform both the S&P 500 (Equally-Weighted) as well as the Bottom Alpha tercile on a risk-adjusted basis after transaction costs based on the portfolio's Coefficient of Variation (CV).

The terciles are rebalanced on a monthly basis. Thus, the study is a Weak-Form Efficient Market Hypothesis test. The research period is December 31, 2002 through December 31, 2011.

The selection of terciling the S&P 500 was done for one predominate reason: the necessity for efficient diversification. Each of the three portfolios has been selected on the basis of alpha alone. Industry and/or sector groups should be accounted for in normal portfolio construction. This is at best pragmatically difficult. Consequently, three large portfolios mitigate this problem. This study was done on a stock selection basis of 167 stocks in the top tercile; 166 stocks in the mid-tercile, and 167 stocks in the bottom tercile.

The Alpha (ALP) employed in this research comes from the same five-year monthly regression used to calculate the beta of a stock against the S&P 500. It is the excess return (positive or negative) not explained by the beta. Excess positive (negative) Alpha is sought by investment managers indicating their superior ability to selecting winning (losing) securities. All investment managers “seek alpha.”

Data and Methods

This paper will explore the total return behavior on a risk-adjusted basis, through the above noted hypothesis. Only one data source, Ford Equity Research of San Diego, was used in this study. Ford Equity Research is a data vendor with proprietary models for investment managers globally and is affiliated with Mergent through stock ownership. See www.fordequity.com for more information

A review of the data and methods used by Ford Equity Research is constructed such that the three most common biases in investment data were eliminated. There is no look-ahead bias, no restatement bias, nor any survivorship bias to the data.

Ford Equity Research, likewise, provided all variables utilized in this study. Total return includes both price changes and dividends. Dividends are included in the appropriate period based on their ex-dividend date. All returns were computed on a geometric basis, as were the standard deviations in conformity with accepted professional investment standards.

All returns were calculated on a monthly basis including the index. Hence, re-balancing occurs on a monthly basis for the entire study period. All returns were computed equally-weighted. All stocks were selected from the noted benchmark S&P 500 Index.

A number of output variables were selected. One key output variable was an estimation of turnover. This allows for the estimation of transaction costs for testing the efficiency of the strategy for both market efficiency and pragmatic investment management. The final portfolios were subjected to a .5% transaction cost utilized by hedge funds in back-testing models.

All three terciles previously noted were constructed utilizing the highest positive Alpha to the lowest negative Alpha. The bottom tercile is therefore also constructed as the “short” portfolio since the research hypothesis states that it will underperform the top tercile portfolio as well as the S&P 500 (Equally-Weighted).

The selection for the sample size is of concern for all researchers. The selection of portfolios of 167-166-167 stocks reduces the impact of industry concentration especially in short time frame studies. Ideally, the number of stocks from one specific industry should be in line with the benchmark index. Even more ideally, the selected portfolio should be of the same

industry weightings as the benchmark index. Unfortunately, there is no computer program in the United States that allows for this type of back-testing without signal manual analysis.

Data Results

The results of the investigation can be found in the following two tables. Table 1 presents the results on a risk adjusted basis *before* transaction costs. Table 2 presents the results on a risk-adjusted basis *after* transaction costs. The performance, again, was computed on a monthly rebalancing basis.

Data Analysis

The results of the study had a number of significant implications. First, the hypotheses were confirmed. The Top Alpha portfolio outperformed the S&P 500 (Equally-Weighted) on both a non-transaction cost and after-transaction cost basis risk-adjusted utilizing the CV. Further, the Top Alpha portfolio outperformed the Bottom Alpha portfolio on both a non-transaction cost and after-transaction cost basis risk-adjusted utilizing the CV.

There are a number of pragmatic investment management conclusions. The first is that *portfolio managers can have a higher probability of achieving the same results as the S&P 500 by selecting only stocks in the Top Alpha tercile category*. Thus, the amount of analytical work is reduced by two-thirds. It must be acknowledged, however, that the portfolio manager could select underperforming stocks within this tercile. *The reduction in analytical work must be contrasted to the fact that the betas of both the top and bottom terciles are different than the equally-weighted beta value of the S&P 500*. Table 3 addresses this situation. It shows, based on year end data for the last five years, a problem does exist but it is not material in nature.

The second pragmatic investment management consideration is the ability to run a risk-free portfolio with returns that outperform US T Bills. This statement must be

carefully noted under two key assumptions. First, the beta of the two portfolios (Top and Bottom) Alphas have the same beta throughout time. This calculation was not done in the study. However, the year-end betas were noted for the past five years of the study. While the averages are close (Top at 1.21 and the Bottom at 1.23), the results were indicative of the economic environment.

It would appear that the Top Alpha portfolio will have a bias towards a higher beta than the bottom over long periods of time of economic advancement. Second, the study was done without inter-period analysis. Consequently, there could be periods in which this positive differential (Long Top Alpha – Short Bottom Alpha) did not hold with resulting drawdowns. Additionally, short selling, even with S&P 500 stocks, can be quite difficult. This difficulty could result in some of the excess profit being lost. Table 3 again discusses this situation over

the past five years of the study utilizing year end data only.

Conclusion

This study examined the weak-form of the EMH utilizing the technical tool of Alpha developed from the characteristic line. The tercile Alpha portfolios of the S&P 500 showed that on an after-transaction basis that the Top Alpha portfolio outperformed ever-so-marginally the equally-weighted S&P 500 utilizing the Coefficient of Variation. This Top Alpha portfolio clearly outperformed the Bottom Alpha portfolio. This could allow for a risk-free arbitrage opportunity.

However, the key implication of this study is that large-capitalization S&P 500 portfolio managers should concentrate most of their stock selection efforts on stocks within the Top Alpha portfolio. It could well be the way to really truly achieve “Excess Alpha” returns.

Table 1: Alpha Tercile Performance Monthly Rebalancing Without Transaction Costs
(December 31, 2002-December 31, 2011)

	Top Tercile	Equally-Weighted Bottom Tercile	S&P 500	
Annual Returns		11.0%	8.0%	9.6%
Standard Deviation		19.3%	22.2%	18.9%
CV		1.75	2.78	1.97

Table 2: Alpha Tercile Performance Monthly Rebalancing After Transaction Costs
(December 31, 2002-December 31, 2011)

	Top Tercile	Equally-Weighted Bottom Tercile	S&P 500	
Annual Returns		9.8%	6.8%	9.6%
Standard Deviation		19.2%	22.2%	18.9%
CV		1.96	3.26	1.97

Table 3: S&P 500 Alpha Terciles for Mean Alpha and Beta data for December year end only

Year End	Top Alpha		Bottom Alpha		Equally-Weighted	
	Portfolio Alpha	Portfolio Beta	Portfolio Alpha	Portfolio Beta	Portfolio Alpha	Portfolio Beta
2011	1.64	1.24	-0.36	1.14	0.61	1.16
2010	1.64	1.26	-0.32	1.10	0.63	1.16
2009	1.72	1.36	-0.37	1.22	0.64	1.19
2008	1.74	1.21	-0.93	1.32	0.43	1.18
2007	1.84	1.00	-0.87	1.37	0.46	1.11
Five Year Average	1.72	1.21	-0.57	1.23	0.55	1.16

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Evaluation of Hospital Financial Performance in Taiwan Following Implementation of National Health Insurance

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Abstract

The financial performance of hospitals in Taiwan is evaluated following the implementation of the National Health Insurance scheme. Results showed that, overall, public hospitals in Taiwan had better liquidity status than private hospitals, but showed poor results for collection delays. Aside from a few foundation hospitals, analysis of capital structure showed almost no long-term debt, suggesting a need to explore capital financing to improve profitability. The majority of private and foundation hospitals showed profitability, but most public hospitals operated at a loss.

Keywords: Hospital financial performance, national health insurance in Taiwan

Introduction

In 1995, the government of Taiwan implemented the National Health Insurance (NHI) scheme, stimulating competition in the health care market. Hospitals in Taiwan are classified by type (medical center, teaching hospital, regional hospital, and district hospital) and region (north, middle, south and east). Since the implementation of the National Health Insurance (NHI) in 1995, out-patient attendance at large hospitals has decreased significantly and small hospitals are finding it increasingly difficult to compete with the large hospitals. Hospital financial and operating performance has a key impact on the role-effectiveness of the various types of hospitals in providing effective and efficient health care in Taiwan. As of 1995, Taiwan had a total of 715 hospitals, including 12 medical centers, 42 regional hospitals, 86 district teaching hospitals, 475 district hospitals, 3 speciality teaching hospitals, 9 psychiatric teaching

hospitals, 18 psychiatric hospitals, and 92 miscellaneous type hospitals (Hospitals Accreditation Report, FY's 1993~1995, Department of Health, Government of Taiwan, ROC; Accreditation of Psychiatric Hospitals Report, FY 1994, DOH). Prior to the implementation of NHI, Taiwan provided public insurance schemes for agricultural workers, laborers, and government employees, but five million people (25% of the total population) were not covered by these plans. NHI was implemented to provide universal coverage, with special emphasis on children, the elderly and the poor. To finance the scheme, premiums were doubled on those who had coverage under the three pre-existing schemes before 1995.

The medical environment in Taiwan differs from that in many Western countries, along with the primary issues in hospital financial management. The following discussion reviews the key characteristics of Taiwan's

medical system, including payment systems, fees and insurance.

Taiwan's NHI system features three types of doctor's wage and salary systems. The first, typical of large private hospitals, is a fee-for-service system established 30 years ago to raise doctor incomes, improve service quality, and reduce the incidence of bribery. This system has been modified to the current physician fee (PF) system, wherein doctors receive 1% of the hospital's fees for examination, handling and surgery as their bonus (Huang, Jiajing, 1996). Since doctor incomes are determined by patient volume and price of service items, this system encourages doctors to treat more patients and provide higher-priced services. According to Lin (1994), prior to the implementation of NHI, 57.5% of regional hospitals used the physician fee system. The second physician compensation system is the salary plus bonus system used in public hospitals, where doctors are paid a bonus are based on hospital profitability. This system encourages the doctors to help the hospital control costs, fixes fee standards and controls factors which impact the market for medical services. The third system is the individual profit system in the small private clinics where doctor incomes are determined by the profits made by hospital profits, encouraging doctors to help increase hospital income and reduce costs.

In terms of fees and insurance payments, 80% of hospital income comes from the Bureau of National Health Insurance through patient claims (known as "written declarations"). The remaining 20% comes

from registration fees, copayments, and minority difference burdens – government subsidies for people below poverty line and poor indigenous populations to cover the 20% copayment. The Healthcare Bureau strictly regulates the list of declarable items and conducts critical audits of medical services and expenses to prevent waste and reduce increases to the overall cost of medicine. The declaration is also involved in the management of hospital accounts receivable. Increased attention should focus on increasing declared expenses, raising the ratio of pre-paid fees, accelerating payments, and reducing the number of rejected declarations.

Financial efficiency is traditionally a key performance factor for most businesses. However, financial efficiency and its attendant concepts and practices are relative novelties in the hospital sector. A hospital's financial condition and focus has a critical impact on its sustainability. (Cleverley, 1987, 1988; Williams D. et al, 1992). Accordingly, interest in this topic has grown among policy makers, hospital management and researchers (Narine et al, 1996).

Despite the research devoted to financial efficiency, basic evaluation standards for hospitals are still lacking. This report concentrates on evaluating four financial efficiency criteria (liquidity, operating ability, capital structure and profitability) along with other factors.

In evaluating a hospital's financial efficiency liquidity and operating ability are assessed in terms of its liquidity ratio, leverage ratio, profitability ratio, and turnover. Research has

shown that, of these four measures, liquidity ratio has a much lower correction rate than the other three (Lynn & Wertheim, 1993).

In terms of capital structure, Taiwan's healthcare system can be usefully compared to that of the United States, where Medicare and other third party insurance companies use the prospective payment system, in which risk is transferred from the payers to healthcare providers. In this system, the amounts that hospitals charge patients for identical services often vary widely. In addition, hospital profitability is limited by increased operating risk, unpaid medical bills, competition from other Medicare providers, and implementation of managed care programs (McCue & Ozcan, 1992), thus increasing the difficulty of debt financing. Under these conditions, hospital management must stay aware of critical factors that impact the hospital's capital structure strategy (e.g., short-term or long-term debt financing). This report will focus on factors affecting capital structure at the financial, organizational and operational level.

Given an understanding of the critical factors affecting profitability, hospital management can act to minimize risk and maximize profit. Policy makers can also benefit from an appreciation of the impact of new policies on hospital operations (Gapenski et al, 1993). Fottler (1987) separated hospital characteristics into two parts: structural factors with a direct impact on hospital financial conditions and profitability, such as size, systemic association and profit; and process factors which have positive impact

on profitability, such as operational strategy and contract management. Clement (1998) found no relationship between process factors and hospital profitability. This report categorizes these structural and process factors into four components: liquidity, operating ability, capital structure, and profitability.

Method

Data was obtained from the National Health Insurance Bureau covering 13 months from 1995 to 1996, following the implementation of NHI. Our sample covered 144 hospitals in Taiwan, including 67 public hospitals, 49 private hospitals, and 28 foundation hospitals. The sampled hospitals are located in all four regions and represent 23.8% of all hospitals in Taiwan, and 48.2% of total bed capacity. Definition and measurement of financial variables were based on the work of McCue and Lynch (1987), which defined specific indicators for financial status and performance, and developed specific quantitative norms indicative of favourable status/performance based on industry averages. Standard definitions used in the health management literature were adopted for performance indicators specific to the hospital industry. Hospitals provide data to the National Health Department in various formats, but these are then standardized in an SAS-compatible format. Statistical methods appropriate to the study objectives and hypotheses were selected, and applied to balance sheets and income statements for 144 hospitals for the fiscal year running from January 1 to December 31.

Results**Descriptive statistics**

As shown in Table 1, the sample for this study included 144 hospitals including 67 public hospitals, 49 private hospitals, and 28 foundation hospitals, respectively representing 79%, 10.6% and 47.5% of all hospitals in each category. In terms of hospital type, the study included 10 medical centers, 22 regional hospitals and 112 district hospitals, respectively representing 71.4%, 48.9% and 20.5% of all hospitals of each type. In terms of regional distribution, the sample included 66 hospitals in south Taiwan, 50 in north Taiwan, 21 in central Taiwan, and 7 in east Taiwan, respectively representing 24.4%, 23.2%, 20% and 50% of all hospitals in each region.

In terms of bed capacity, the sample included 50 hospitals with fewer than 100 beds, 35 with 100-299 beds, 22 with 300-499 beds, 20 with 500-99 beds, and 7 with more than 1000 beds, respectively representing 14.4%, 35%, 53.7%, 55.6%, and 63.6% of the total number of hospitals in each size classification.

Refer Table I**Descriptive statistics of hospital income**

In our sample, approximately equal numbers of hospitals reported profits or losses from medical services. When sorted by hospital ownership type, 22.4% of 67 public hospitals showed positive earnings from medical services (i.e., a positive operating margin), as opposed to 70% of the 29 foundation hospitals, and 73% of the 49 private hospitals. When sorted by level, 48% of the

22 regional hospitals reported positive earnings, as opposed to 50% of the 10 medical centers, and 51% of the 112 district hospitals.

When the level of hospitals was collapsed within each ownership type, the loss ratio among public hospitals is highest in medical centers, followed by district hospitals and regional hospitals. Among foundation hospitals, earnings were higher for medical centers, followed by district hospitals and regional hospitals.

Refer Table II**Reinvestment capacity**

About half of public medical centers had good reinvestment ability, as opposed to 26.9% of public hospitals. Sorted by level, medical centers had better performance, with about half exhibiting good reinvestment ability.

Refer Table III**Descriptive statistics of hospital liquidity and capital structure**

In terms of liquidity measures, the current ratio status is satisfactory among the sample hospitals, indicating satisfactory liquidity status. Private hospitals show relatively poorer liquidity and short-term liability status with low current ratios. However, public hospitals need to reduce the current delay in clearing accounts receivable. When reviewed by in terms of hospital level, increased level correlates positively with improved liquidity status.

In terms of capital structure, the sample hospitals seldom used financial leverage or used short-term debt to fund capital

requirements. Private and the regional hospitals tended to resort to debt financing while foundation hospitals and medical centers funded operations and expansions through capital. Higher hospital level correlates positively with capital structure.

Refer Table IV

Descriptive statistics of hospital liquidity and capital structure

Effective operations require managers to carefully evaluate the turnover of each type of asset. This could be due either to use or reduction of assets. Overall, in private and regional hospitals, increased turnover was found to be associated with a decrease in assets, but this is beyond the scope of this research.

When sorted by hospital type, public hospitals fared the worst in terms of profitability indicators. Sorting by level failed to produce a uniform pattern, and when sorted by level, the ranking proceeded from medical center to district hospital to regional hospital. Caution must be exercised when evaluating return on equity as a measure of profitability.

Refer Table V

Overall, our evaluation of hospital financial effectiveness indicates the following salient features of the sample hospitals:

- (a) High current ratio and short-term debt.
- (b) Relatively low use of financial leverage, and reliance on short-debt for capital requirements, with the exception of some foundation hospitals.

(c) Very low or negative profitability of public hospitals as compared with private hospitals.

(d) Higher level hospitals are in relatively better financial shape.

Discussion and Conclusions

Findings are discussed in comparison with comparable indicators of hospital financial performance in the United States.

Liquidity analysis

Hospitals in Taiwan had lower current and quick ratios than their American counterparts, but a higher acid-test ratio. This indicates that the total value of accounts receivable at Taiwan hospitals is lower than in the US, and that collection period is 10 days lower. The day's cash on hand is considerably greater than in the US, (39.8 days for Taiwan as opposed to 13.1 days for the US). The average payment period in Taiwan is 20 days longer than in the US (74.1 days vs. 53.3 days), suggesting relatively lower payment ability and credit availability in Taiwan. This also explains the lower long-term debt-to-equity ratio of Taiwan hospitals and their reliance on short-term debt for their capital needs. Most liquidity indicators were more favourable for Taiwan hospitals than for their US counterparts.

Overall, Taiwan hospitals have few short-term debt problems. Sorted by hospital type, private hospitals tended to have the poorest short-term debt conditions, with low current ratios and fewer days cash on hand, though they had a shorter payment collection period than other hospital types. This is possibly

due to the small scale of most private hospitals with little current capital and relatively fewer accounts receivable. Public and foundation hospitals were better off, but long collection periods need to be reduced. Higher level hospitals had relatively better liquidity positions, possibly because such hospitals have higher profits from medical services, resulting in increased accounts receivable and cash levels adequate to meet short-term debt needs. Another explanation is that most Taiwan hospitals are non-profit, and thus require less investment and therefore have more cash on hand.

Capital structure analysis

The most outstanding difference in capital structure between Taiwanese and American hospitals is the relatively low use of financial leverage in Taiwan where, due to traditional conservatism in the industry, most capital resources are raised using short-term debt. With the exception of a few hospitals carrying long-term debt, most support operations and expansion with ownership capital. For public hospitals that have only recently installed professional accounting systems, government subsidies make up most uncovered expenditures, thus precluding the need for debt financing, and reducing long-term debt to nearly zero. Foundation hospitals adopt a conservative approach to financing partly because of tax structures: Operating margin exceeding 20% are subject to tax, thus these hospitals prefer to refinance using profits to the extent that operating margins are kept below 20%. In addition, subsidies for medical foundations are not taxed, which also contributes to long-term

liability. Private hospitals have a greater tendency to take on debt, probably because small and medium sized hospitals have limited capital and need to raise loans to fund operations and expansion. Foundation-run hospitals and medical centers tend to have plenty of capital which contributes to increased income, and tend to have more cash on hand and other liquid assets, thus mooted the need for loans.

Operating ability analysis

Turnover indicators show that hospitals in Taiwan have a total asset turnover rate of 85.5%, and a current assets turnover rate 253.6%, both lower than their US counterparts (96% and 388%, respectively), but had a higher fixed assets rate (320%) vs. 175%). This indicates that Taiwan hospitals are relatively more efficient in terms of asset use.

Sorted by hospital type, private hospitals had the highest rates of total asset turnover and current asset turnover. Sorted by hospital level, higher level hospitals were associated with lower total assets turnover, which could be due to two possible explanations. First, private hospitals (including most district hospitals) showed high rates of asset usage effectiveness, resulting in an apparent correlation between hospital level and asset usage effectiveness. Second, smaller total asset holdings are typically associated with high turnover, particularly in the private sector, which could be a factor given that most district hospitals are privately-run. Public hospitals show the highest turnover of fixed assets, followed by private and

foundation hospitals, possibly because public hospital capital accounts do not reflect actual land costs, resulting in their fixed assets being significantly undervalued as compared to other types of hospitals, thus leading to inflated turnover statistics. Based on this study, there appears to be a case for recommending the government review investment measurements before buying fixed assets.

Profitability analysis

Every profitability index shows that Taiwan hospitals are less profitable than those in the US. This could be due American hospitals placing a greater emphasis on profitability. Also, non-operating revenue is relatively lower in Taiwan, indicating that the major revenue source for Taiwan hospitals was derived from performing medical services.

Public hospitals had the lowest overall profitability levels, and higher losses, a pattern which also prevailed in terms of turnover. The explanation for this is probably the same as that for asset turnover.

On the whole, Taiwan hospitals had less short term liability than US hospitals. The most outstanding difference seen in liability structure lies in the fact that Taiwan hospitals have almost no long-term debt and relatively higher amounts of short-term debt, while US hospitals are more prone to using financial leverage. Among Taiwan hospitals, foundation hospitals exhibited the highest degree of financial effectiveness while public hospitals were the least effective. It is possible this results from differences in management, where foundation hospital executives are more entrepreneurial and better attuned to issues including operational effectiveness, cost control and revenue maximization. Public hospitals are also limited by their systems for human resource management, accounting and purchasing high personnel and purchasing costs eroding their competitiveness. Differences in accounting methods also apparently contributed to the relative financial effectiveness of public hospitals.

Table I: Characteristics of sample hospitals

	Total Hosp.	Sample #	Percent	Statistic value
Type of Hosp.				
Public	84	67	79.80%	$X^2=101.44^*$
Private	462	49	10.60%	
Foundation	59	28	47.50%	
Level of Hosp.				
Medical Center	14	10	71.40%	$X^2=17.83^*$
Regional Hosp.	45	22	48.90%	
District Hosp.	546	112	20.50%	
Region				
North	216	50	23.20%	$X^2=3.29$
Central	105	21	20%	
South	270	66	24.40%	
East	14	7	50%	
Bed capacity				
<100 Beds	417	60	14.40%	$X^2=41.75^*$
00-299 Beds	100	35	35%	
300-499 Beds	41	22	53.70%	
500-999 Beds	36	20	55.60%	
>1000 Beds	11	7	63.60%	
Mean Bed capacity	154.5	312.6		$t = 0.55$
Total Hospital	605	144	23.80%	
Total Beds	93742	45014	48.20%	

Note: 1.*denotes Z-value significance at 5%. 2. Significance level = 0.05. 3. Sample # denotes number of hospitals.

Table II: Income by level and type

	Hosp no.	Medical Income		Total Income	
		Loss	Gain	Loss	Gain
Medical Center Public	6	5 (83.3%)	1 (16.7%)	3 (50%)	3 (50%)
Foundation	4	0 (0%)	4 (100%)	0 (0%)	4 (100%)
Total	10	5 (50%)	5 (50%)	3 (30%)	7 (70%)
Regional Hosp. Public	14	10 (71.4%)	4 (28.6%)	10 (28.6%)	4 (28.6%)
Foundation	8	3 (37.5%)	5 (62.5%)	2 (75.0%)	6 (75%)
Total	22	13 (59.1%)	9 (40.9%)	12 (45.5%)	10 (45.5%)
District Hosp. Public	47	37 (78.7%)	10 (21.3%)	35 (74.5%)	12 (25.5%)
Private	48	13 (27.1%)	35 (72.9%)	15 (31.3%)	33 (68.7%)
Foundation	17	5 (29.4%)	12 (70.6%)	9 (52.9%)	8 (47.1%)
Total	112	55 (49.1%)	57 (50.9%)	59 (52.7%)	53 (47.3%)
Total Public	67	52 (77.6%)	15 (22.4%)	48 (71.6%)	19 (28.4%)
Private	48	13 (26.5%)	35 (73.5%)	15 (30.6%)	33 (69.4%)
Foundation	29	8 (28.6%)	21 (71.4%)	11 (39.3%)	18 (60.7%)
Total	144	73 (50.7%)	71 (49.3%)	74 (51.4%)	70 (48.6%)

Table III: Reinvestment ability by level and type

	Reinvestment Ability	
	Poor (%)	Good (%)
Medical Center Public	3 (50%)	3 (50%)
Foundation	0 (0%)	4 (100%)
Total	3(30%)	7 (70%)
Regional Hosp. Public	10 (71.4%)	4 (28.6%)
Private	2 (25%)	6 (75%)
Total	12 (54.5%)	10 (45.5%)
District Hosp. Public	36 (76.6%)	11 (23.4%)
Private	15 (31.3%)	33 (68.7%)
Foundation	9 (52.9%)	8 (47.1%)
Total	60 (53.6%)	52 (46.4%)
Total Public	49 (73.1%)	18 (26.9%)
Private	15 (30.6%)	34 (69.4%)
Foundation	11 (39.3%)	17 (60.7%)
Total	75 (52.1%)	69 (47.9%)

Table IV: Liquidity and capital structure

Panel A		Type of hospital		
	Total	Public	Private	Foundation
Liability				
Current Ratio	1.68	1.95	0.71	2.1
Quick Ratio	1.43	1.62	0.51	1.7
Acid-Test Ratio	0.46	0.57	0.16	0.89
Day in Accounts Receivable	53.6	83.04	0	41.7
Capital Structure				
Average Payment Period	74.08	74.86	70.96	77.11
Days cash on hand	39.8	52.71	14.84	71.72
Capital Structure				
Equity Financing Ratio	0.48	0.54	0.18	0.6
Cash Flow to Total Debt	0.06	–0.396	0.21	0.16
Debt Service Coverage	0.08	–0.396	0.29	0.18
Long-term Debt to Equity	0	0	0	0.03
Total Debt to Equity	0.9	0.94	1.02	0.6
Long-term Debt to Net Fixed Assets	0	0	0	0.03

Panel B		Level of hospital		
	Total	Medical Center	Regional Hosp.	District Hosp.
Liability				
Current Ratio	5.04	1.52	1.61	1.84
Quick Ratio	4.75	1.44	1.34	1.56
Acid-Test Ratio	3.19	0.48	0.45	0.24
Day in Accounts Receivable	62.27	54.37	52.19	63.58
Capital Structure				
Average Payment Period	55.27	69.82	77.22	53.25
Days cash on hand	176.13	47.82	31.12	13.12
Capital Structure				
Equity Financing Ratio	0.88	0.49	0.45	0.49
Debt Service Coverage	0.68	0.09	0.07	–
Long-term Debt to Equity	0	0	0	0.67
Total Debt to Equity	0.14	1.03	0.91	–
Long-term Debt to Net Fixed Assets	0	0	0	0.59

(Indicator selection based on: McCue, M.J., and Lynch, J.R., 1987)

Table V: Operating ability and profitability

Type of hospital	
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	Total	Publics	Private	Person
Operating Ability				
Total Assets Turnover	85.46	84.71	167.78	71.77
Fixed Assets Turnover	320.13	570.38	394.09	126.2
Current Asset Turnover	253.6	185	692.04	231.47
Profitability				
Markup	1.01	0.81	1.06	1.04
Operating Margin	-0.01	-0.247	0.04	0.02
Total Margin	0	-0.197	0.04	0.01
Non-operating Rev.	0.01	0.01	0	0.03
Return on Total Assets (%)	-0.28	-12.40	7.31	0.97
Return on Fixed Assets (%)	-0.34	-33.70	13.88	1.69
Profit/(FA-Land) (%)	-0.79	-67.54	11.78	2.05
Return on Equity (%)	-1.92	-21.5	11.68	1.8
Level of hospital				
	Total	Medical Center	Regional Hosp.	District Hosp.
Operating ability				
Total Assets Turnover	55.91	82.75	98.57	96
Fixed Assets Turnover	119.22	499.99	323.14	175
Current Assets Turnover	137.47	310.42	255.49	388
Profitability				
Markup	1.04	0.98	1.01	1.24
Operating Margin	0	-0.060	0.01	0.03
Total Margin	0.02	-0.036	-0.009	–
Non-operating Rev.	0.07	0.02	0	0.31
Return on total Assets (%)	2.56	-5.30	-0.49	5
Return on Fixed Assets (%)	7.75	-7.70	-0.62	–
Profit/(FA-Land) (%)	9.48	-22.17	-0.79	–
Return on Equity (%)	3.73	-8.84	-2.20	9

(Selection of indicators was based on: McCue, M.J., and Lynch, J.R., 1987)

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The Effects of M&A on the Change of Productivities – Evidence From The**Japanese Shinkin Banks****Dai jianzhong****Abstracts**

In this paper we examine the effects of merger and acquisition (M&A) incidents occurred in the period of financial year (FY) 2001-FY 2004 on the productivity changes of the Japanese shinkin banks during the period of FY 2005-FY 2008. We use a two-stage approach to analyze the effects of M&A on the productivity change. To deal with measure error and endogenous problems inherent in the second stage regressions, this paper uses a semi-parametric bootstrapping approach to get more robust estimates of the coefficients in the model. The paper finds that M&A incidents and some other related variables have significant effects on the productivity change and its components.

Keyword: DEA; Malmquist index; semi-parametric bootstrapping; banking

JEL code: C14 D24 G21 O47

Introduction

This paper examines the effects of merger and acquisition (M&A) incidents occurred during the fiscal year (FY) 2001 to FY 2004 on the productivity changes of the Japanese shinkin banks in FY 2005 to FY 2008. Shinkin bank is a kind of regional financial institutions in Japan. They are non-profit mutual financial institutions aimed at servicing small and middle enterprises (SMEs) and local inhabitants.

From the beginning of 21st century, the supervision environment for financial institutions in Japan experienced great changes. With the progress of deregulation and financial liberalization, the permitted business scope of financial institutions was widened and the boundary between different kinds of financial institutions became obscured. These changes triggered a wave of M&A among shinkin banks at the beginning of 2000s (see graph 1). As the result, the number of shinkin banks decreased from 371 at the end of FY 2000 to 279 by the end of FY 2008. It is interesting to analyze the effects of this peak of M&A activities on the

productivity changes in the shinkin banks.

Refer Figure I

The influence of M&A is a major concern of many papers about the determination of efficiency and productivity changes in financial institutions. Interests in this area are not purely due to academic curiosity. They also come from policy considerations. Encouraging M&A among financial institutions is an important component of bank restructuring policy packages in many countries. Therefore understanding the impacts of M&A on the efficiency and productivity changes in financial institutions has significant policy implications.

Unfortunately there is no consensus among researchers about the effects of M&A on the efficiency and productivity changes in firms. Many researchers argued that M&A will improve the efficiency of the involved firms through: (1) technology transfers between the participant firms, (2) economy of scale and economy of scope improvement due to M&A, (3) reduction of overcapacity and redundant labors often carried out after

M&A. On the other hand, M&A may increase the market power of the involved firms. This may increase the efficiency measured in value terms. But it may also reduce their motive for innovation. Thus it may decrease their efficiency measured in technical terms and also be disadvantageous to the interests of consumers.

There are by now many empirical researches in this field. For example, Berger and Humphrey (1992) studied 57 M&A case among large US banks during the period 1981 to 1989. Hahn (2007) analyzed the effects of M&A on the efficiency of Austrian banks during the period of 1995-2002. Al-Sharkas et al. (2008) analyzed the impact of M&A on the efficiency of the US banks for the period from 1985 to 2002. Rezitis (2008) analyzed the effects of bank mergers on the efficiency and of productivity changes for ten Greek banks from 1993 to 2004.

Several researchers focus on the M&A among credit unions and other small financial institutions. For example, Grifell-Tatjé and Lovell (1996) analyzed the effects of M&A on the productivity changes of the Spanish saving banks from 1986-1991. Vennet (1996) analyzed the effects of M&A on the cost efficiency and other financial profit indicators of the credit union in Europe over the period of 1988-1993. Fried et al. (1999) analyzed the effects of mergers on the efficiency of credit union of the United States from 1989-1995. Garden et al. (1999) analyzed the effects of mergers on the efficiency changes of the credit union in Australia during the period of 1992-1997. Haynes and Thomson (1999) analyzed the effects of M&A on the productivities of the building society in U.K. Devaney and Weber (2000) analyzed the effects of market structure on the productivity changes in the rural banking sector of the United States during the years from 1990-1993.

Corresponding to the inconsistency in the theoretical explanation, the conclusions of the empirical literature about the effects of M&A on the efficiency are mixed. Some have found no evidence (Grifell-Tatjé and Lovell 1996, Garden et al. 1999, Devaney and Weber 2000, etc.) that M&A had significant effects on the efficiency of the banks. Some (Fried et al 1999, etc.) found mixed evidences about the effects of M&A. some (Rezitis 2008, etc.) even reported negative effects of M&A on efficiencies. On the other hand, others (Vennet 1996, Haynes and Thomson 1999, Al-Sharkas et al 2008, etc.) have found positive relationship between M&A and efficiency.

There are also several papers which concerns the small and middle financial institutions in Japan. These papers either directly analyzed the effects of M&A activities or used M&A as an important control variable. For example, Hoshino (1992) analyzed the effects of M&A on some simple financial ratios of the small and medium financial institutions in Japan. Fukuyama (1996) analyzed the return of scale of credit unions in FY 1992. Harimaya (2004) analyzed the correlation between the efficiency and dividend policy of the shinkin banks by using the data of FY 2002. Horie (2010) analyzed the relationship between the operation areas and the productivity changes in the Japanese shinkin banks during the period of FY 2005-FY2008. In this paper I use the same selection of inputs and outputs as Horie when calculating the productivity changes of the shinkin banks. I also follow his idea of weighted average when measuring some variables for the regional economic environments.

Measuring the effects of M&A on the efficiency or change of productivities is not an easy task. Some analysts (Fried et al. 1999, Rezitis, 2006, etc.) directly calculated

the efficiency changes of the banks involved in M&A activities before and after the occurrence of M&A. However, this approach is problematic. M&A activities will cause discontinuity of data for the acquired or closed banks. As for the acquiring or the merging banks (some with a new name), the operating environment also has greatly changed; hence simple comparison of these banks before and after the merging is misleading. In our case of Japanese shinkin banks, some banks even experienced more than two M&A during the sample period, which makes the problem even more complex. Noticing this problem, some researchers (Ralston et al. 2001, etc.) compared the efficiency scores of the bank formed after M&A with the weighted average of the efficiency scores of the merged and merging banks before M&A. Alternatively some researchers (Cooper, Seiford et al. 2006) advocate comparing a virtual bank which have aggregated inputs and outputs of the merged and merging banks to the bank formed after M&A. This is also questionable. For due to the nature of the measurement, the average radial efficiency score of two or more banks is not always equal to the efficiency score of the bank with aggregated inputs and outputs of these banks (Fried, Lovell et al. 2008).

This paper does not simply compare the efficiencies of the banks which involved in M&A activities before and after the M&A incidences. Instead it compares the productivity changes between the banks involved in M&A activities before the sample period with those not involved. All those which involved in M&A activities during the sample period are deleted from the sample. The effects of M&A are inferred from the differences between these two groups.

The paper also makes several other contributions to the literature. First of all, in order to get a more objective measuring of efficiency, it uses the hyperbolic-oriented distance instead of input or output-oriented Shephard distance as the measure of efficiency. This approach avoids the possible discrepancy between the input and output-oriented measurements and is also more closely related to the traditional profit concept. Second, to deal with measurement error and endogenous problems inherent in the second stage regressions, this paper uses the algorithm suggested by Simar and Wilson (2007), but with a few alternations. To avoid the problem of bounding of the dependent variable, instead of using efficiency scores this paper uses a productivity change index called Malmquist index as the dependent variable. This avoids using the censored or truncation models and makes it possible only using OLS models, because Malmquist index is only low-bounded by 0. Finally, following Horie (2010), this paper uses weighted regional economic data as the control variables. Compared to macroeconomic data, which are used in most of the other related papers, regional data are more suitable for the analysis of the regional financial institutions. The rest of the paper is arranged as follows: Section 2 makes a brief review of the literature about the methodology used by the paper. Section 3 describes the data and the variables used in the paper. Section 4 gives the results of the estimation and makes some analysis about them. Section 5 draws conclusions from the analysis.

The methodology

We use a two-stage approach to analyze the effects of M&A on the productivity changes. It consists of two stages: in the first stage, a productivity change measure called Malmquist index and its decomposition are

calculated. In the second stage, the estimated Malmquist index and its decomposition are regressed on several environmental variables and a technique called semi-parametric bootstrapping is used to test the significance of the parameters of the model.

A. Estimation of productivity changes

In Malmquist index, the productivity change of a decision making unit (DMU) is measured as the ratio of efficiency of the DMU between two periods. Efficiency means the relative performance of a DMU compared to the potential performance. Generally Shephard distance is used as the measure of efficiency. In each year, we can derive a production frontier (consisted by those efficient combinations of input-

Mathematically, we can define the production set Ψ^t at time t as:

$$\Psi^t = \{(x, y) \in \mathbb{R}^{N+M} \mid x \text{ can produce } y \text{ at time } t\} \quad (1)$$

where $x \in \mathbb{R}^N$ are N dimension vector of inputs and $y \in \mathbb{R}^M$ are M dimension vector of outputs. The Shephard hyperbolic distance $D_0^{t,t}$ is defined as:

$$D_0^{t,t} = \sup\{\gamma > 0 \mid (x/\gamma, \gamma y) \in \Psi^t\} \quad (2)$$

Where γ is the scale that needed to decrease x_0 and increase y_0 simultaneously to push the point (x_0, y_0) to the efficient frontier $\partial^t Q(x, y)$ (the set that constituted by efficient DMUs, which are those points with $\gamma = 1$).

Since hyperbolic-oriented distance considers both the output and input efficiency, it avoids the problem of possible discrepancy between input and output-oriented distance (Fukuyama, 1996). Thus it is a more objective measure of efficiency. It is also more related to the concept of profit, which is the conventional measurement of efficiency.

Beside calculating the distance of DMU i in year t according to the frontier of year t as

outputs) based on the performance of all DMUs in that year. In the output-input space, Shephard distance is the relative distance from the point of that DMU to the “frontier” along a certain direction.

Shephard distance can be estimated either along the direction of inputs or outputs or any other arbitrary directions. In this paper we use the hyperbolic-oriented distance to measure the efficiency. For an arbitrary production point (x_0, y_0) , the hyperbolic-oriented distance is defined as the proportion needed to simultaneously reduce the inputs and increase the outputs to push a point to the frontier.

$D_i^{t,t}$, we can also estimate the distance of DMU i in year $t+1$ according to the frontier of year t as $D_i^{t,t+1}$. Similarly we can calculate the distance of DMU i in year t and $t+1$ both according to the frontier of year $t+1$ as $D_i^{t+1,t}$ and $D_i^{t+1,t+1}$ respectively; then we can get two

expressions of productivity changes as M_i^t and M_i^{t+1} :

It is very likely that these two ratios are different; Malmquist index (M_i) is the geometric average of the two¹⁸:

$$M_i = (M_i^t \times M_i^{t+1})^{1/2} = \left[\frac{D_i^{t+1}}{D_i^t} \times \frac{D_i^{t+1,t}}{D_i^{t,t+1}} \right]^{1/2}$$

The explanation of Malmquist index depends on the method used for the calculation of the distance D . For the input-oriented or hyperbolic-oriented distance, a larger (smaller) value of M means deterioration (improvement) of productivity over time. On the other hand, for the output-oriented distance, a larger (smaller) value of M means an improvement (deterioration) of productivity over time.

In order to detect the sources of productivity changes, we need to decompose the above Malmquist index into several components. One of the most widely used decomposition methods was first proposed by Färe, Grosskopf, Lindgren and Ross (1992):

$$M = E \times S \times T \quad (4)$$

M is the Malmquist index. E is the change of pure technical efficiencies. It measures the change of position of a DMU according to the current frontiers between year t and $t+1$ under the assumption of variable returns to scale (VRS). S is the change of scale

economy. Scale economy is measured as the ratio of distance to the current frontier under the assumption of constant return of scale (CRS) to the distance to the current frontier under the assumption of VRS. T is the technological changes. Since it measures the effect of the moving of the CRS production frontier from period t to $t+1$ on the productivity changes of a DMU, it is also called “frontier shift effects”. As in the case of total score, for the input-oriented or hyperbolic-oriented distance, a larger (smaller) value of component means deterioration (improvement) of the component over time.

I use Data Envelopment Analysis (DEA) approach to estimate the hyperbolic oriented distance. DEA identifies those efficient DMUs by solving a programming. The production frontier is the convex combination of these optimal points. For input or output-oriented distance, the programming is linear. For hyperbolic-oriented distance the programming is non-linear, but with the help of computer it can also be easily solved by recursive trying. For technical details of the programming, see Wheelock and Wilson (2009).

B. Problems with the second stage models

Suppose, for a DMU i , $i = 1, 2, \dots, n$, it can use

\mathbf{x}_i to produce \mathbf{y}_i , it has a efficiency measure

of γ_i , γ_i is determined by a vector of environmental variables \mathbf{z}_i , then the basic two stage model is:

$$\gamma_i = \mathbf{z}_i \boldsymbol{\beta}_i + u_i, \quad i = 1, 2, \dots, n$$

(5)

¹⁸ Since Malmquist index is a commonly

used indicator for productivity changes we will not explain its technical details here.

Those who are not familiar with it can see Fried et al (2008).

u_i is the error term.

Among those papers which used the two-stage models, in the first stage most researchers used the efficiency score as the dependent variables. In the second stage, some analysts just used OLS (Garden et al. 1999, Devaney and Weber 2000, Ralson et al. 2001) to estimate the model.

However, for the second stage regression models using efficiency score itself as the dependent variable, several problems have to be solved. First of all, the dependent variable (the efficiency measurement γ_i) is bounded.

For the input or hyperbolic- oriented distance, it is low bounded by 1. For the output-oriented distance, it is low bounded by 0 and upper bounded by 1.

To solve the bounding problem of the efficiency scores, in the second stage most researchers used censored or Tobit (e.g. Hahn 2007) models to estimate the coefficients of the model. Simar and Wilson (2007) argued that truncated model may be more suitable in this case. Some analysts (Fried et al. 1999) used logit models to analyze the problem.

Another way to solve the problem is to use some ratio of the efficiency measure as the dependent variable. For ratios such as the Malmquist index are only low bounded by 0; therefore models using these ratios as dependent variable can be estimated by OLS.

Second, the dependent variable γ is not an observed variable. It itself is estimated from the sample in the first stage. By construction the dependent variable γ is serially correlated. This is because γ_i is measured as the distance to the frontier and the entire

sample x and y are involved in the construction of the frontier. Any DMU's change of x and y may cause change of the frontier, thus the efficiency scores of all the DMUs. The fact that γ_i is correlated with

any x and y also means u_i is correlated with z_i , because the choice of x and y of the DMU

i is conditional on z_i , thus here we also face a endogenous problem.

The third problem is that although $\hat{\gamma}$ is a consistent estimator, it is a biased estimator of real γ . Thus we also face a measure error problem in this model. This bias is also correlated with x and y , thus the z , and disappears at a slower rate than that of the traditional econometric models.

The two and third problems are more difficult to deal with. Traditional econometric techniques cannot be used to handle these problems.

Simar and Wilson (2007) designed a more advanced semi-parametric approach for solving the problem. This paper uses a semi-parametric approach similar to that suggested by Simar and Wilson to estimate the second stage model. But unlike the original model, I choose Malmquist index as the dependent variable. To further simplify the problem, I take log of the ratio. As mentioned above, ratios like the Malmquist index are only low bounded by 0. Their logarithms can even take negative values. Thus it avoids the bounding problem that efficiency measurement will face.

The Simar and Wilson approach has two algorithms. In the first approach, we first run a regression model, then form new efficiency scores by randomly combining the fitted

value and residuals. The Simar and Wilson approach has two algorithms. This paper only uses the first one because the second algorithm involves using the estimated efficiency score (such as the Shephard distance) and its residuals to generate new input and output samples. Hence it is unsuitable in the case of Malmquist index. For details about the problems in the second stage model and bootstrapping approach used in the model, see Simar and Wilson (2007).

C. model specification

Except the Malmquist index, the paper also regress the components of the Malmquist index on the same environmental variables. Then we will get a system of regression equations:

$$\ln M = \mathbf{z}\boldsymbol{\beta}_m' + \mathbf{u}_m,$$

$$\ln E = \mathbf{z}\boldsymbol{\beta}_e' + \mathbf{u}_e,$$

$$\ln T = \mathbf{z}\boldsymbol{\beta}_t' + \mathbf{u}_t,$$

$$\ln S = \mathbf{z}\boldsymbol{\beta}_s' + \mathbf{u}_s,$$

$$St.\ln M = \ln E + \ln T + \ln S$$

Utilizing the constraint, only three out of the four equations can be estimated. I omitted the equation for pure efficiency changes and estimate the remained three equation using OLS method. The coefficients of the omitted equation for pure efficiency and their significance levels can be deduced from the estimated models. The vector of coefficient of the equation for LnE is: $\boldsymbol{\beta}_e = \boldsymbol{\beta}_m - \boldsymbol{\beta}_t - \boldsymbol{\beta}_s$

and their corresponding variance is:

$$VAR(\boldsymbol{\beta}_e) = VAR(\boldsymbol{\beta}_m) + VAR(\boldsymbol{\beta}_t) + VAR(\boldsymbol{\beta}_s).$$

With the estimate and its variances, it is easy to obtain its significance level. However, because the variances of the estimates are larger than those obtained by traditional method, its significant level will be underestimated. In this case bootstrapping

method is a more accurate estimate. Through bootstrapping, we can obtain B estimate of each coefficient: $\boldsymbol{\beta}_e^* = \boldsymbol{\beta}_m^* - \boldsymbol{\beta}_t^* - \boldsymbol{\beta}_s^*$. The

bootstrapping significant level can be estimated by using the quantile approach described above.

The paper is especially interested in the effects of M&A incidences on the productivity changes. I set dummies to capture the effects of M&A. It may take times for the participant banks to integrate their operations and cultures. Therefore, the effects of M&A on productivities of the involved banks may at first decrease, then gradually increase and finally will disappear. To capture this dynamics the paper set 4 time dummies (date01, date02, date03 and date04): $Date_{it} = 1, t = 01, \dots, 04$, if shinkin

bank i experienced M&A during the fiscal year of t .

To control for other factors that may influence the productivity changes, the paper includes several control variables in the second stage model. These variables can be divided into two categories: Internal factors and external factors. Corresponding to the differentiation and logarithm of the dependent variables, all of these control variables are differentiated and taken log. Internal factors are bank specific variables that may influence the productivity of the banks. In our model, these factors include:

(1) Total income (asset), as the indicator of bank scale. According to the firm theory, for each industry, there is an optimal scale of production. For firms smaller than this optimal level of scale, increasing the scale of production will increase their productivities. On the other hand, for firms larger than this optimal level of scale, the increasing the scale of production will have negative effects on their productivities. For

regional institutions like shinkin banks, their business is limited in a relative small area; thus we should expect their optimum scale to be much smaller than national financial institutions. Due to these considerations the sign of the variable is hard to be determined in advance.

(2) Risk level indices. Since risk taking behaviors and the profits of banks are correlated, these indices certainly will have effects on the productivities of shinkin banks. The paper chooses three indices as the indicators of risk taking.

(2.1) Risk adjusted capital adequacy ratio (CAR), the capital/risk weighted asset ratio defined by the Basle Accord. The sign of this coefficient is not easy to predict. Higher CAR ratio means a larger proportion of bank fund is not used in more profitable projects. This is detrimental to the productivity. On the other hand, a strong capital position makes it possible for banks to take riskier projects. This will improve their productivities. The results of empirical studies in this field are mixed.

(2.2) Non-performing loans/ total loans ratio (npl); higher NPL ratio will reduce the productivities of the banks, thus this variable should have negative effects on the change of productivities

(2.3) Loan loss provisions / total loan ratio (lp). The effects of this variable are similar to that of CAR.

(4) **Indices of administration efficiency**, an efficient administration will reduce the cost of production and strengthen the control of risk. Thus it will certainly have effects on the productivities of shinkin banks. Following Horie (2010), this paper includes three indicators of administration efficiency in the model:

(4.1) Labor efficiency of the headquarter (LH): the numbers of staffs in

the headquarter divided by the numbers of offices in headquarter.

(4.2) Organizational efficiency (NH): Number of department in the Headquarter / number of branches.

The two variables reflect the efficiency of headquarters. The higher the ratios, the higher the operating expense of headquarter is. However, higher ratio also reflects higher ability of supervision and risk control. Therefore the sign of these two variables are not predetermined.

(4.3) efficiency of the Branch (LB): average number of employees per branch: This variable reflects labor efficiency of branches. Thus it should have negative effects on productivities.

External factors are those variables out of the control of the banks that affects the productivity of the shinkin banks. All of these factors are indicators of operating areas. Operating areas is the economic and social environment in which a bank operates. As a kind of regional financial institution, shinkin bank's activities are limited in a specific geographic area. Unlike large financial institutions which operate in a national scope, the economy of the region over which a shinkin bank operates plays a key role in the determination of its productivities (Horie 2010). In the model of this paper I use several economic and social variables as the indicators of operating area. These variables include:

(1) $Share_i$: the ratio of the number of branches of shinkin bank i to the total number of branches of all financial institutions operating in the same region -an indicator of market power of shinkin banks. The role of market power in the determination of productivity changes is not certain. On one hand, high market power may discourage a bank to improve its

efficiency and technology, thus its productivity growth rate may be low; on the other hand, high market power also gives bank high price fixing ability; therefore its productivity growth rate measured in value terms may be high. Due to these conflicting effects, the sign of market power indicators in the model is not easy to be pre-assumed.

The model also includes three indicators for the level of regional economic activities:

(2.1) y_i : The taxable personal income of the region in which shinkin bank i operates.

(2.2) $inst_i$: The number of enterprises of the region in which shinkin bank i operates.

(2.3) $manu_i$: The value of manufactures of the region in which shinkin bank i operates.

It is reasonably predicted that banks operate in areas which have high economic activities should have high rate of productivity growth; Thus these three variables all should have positive effects on the productivity growth. Population problem now is a key factor that influencing the Japanese economy. Thus the model specially includes two indicators of the characters of population in the region:

(3.1) pop_i : The population density of the region in which shinkin bank i operates. High density of population normally indicates more members and customers for the shinkin banks. Therefore it should have positive effects on productivity changes.

(3.2) old_i : The proportion of aged families to the total number of families in the region in which shinkin bank i operates. High proportion of aged families is disadvantageous for the regional economy. Thus this variable should have negative effects on productivity changes of the banks.

I use “city, town or village” (shi, mura or machi) as the unit of region. Since many shinkin banks operate over more than one city, I use weighted average of city statistics of the above variables as the indicator of operating area. The weight is the ratio of the number of branches in city i of shinkin bank j to the total number of branches of bank j in year t .

Since the scale of city is different, it is questionable to treat each city equally. To avoid this problem, the three quantity variables for economic activities are expressed in term of value per acreage.

Because external variables are weighted average, thus the change of these variables for a shinkin bank can be originated either from the change of the variables themselves in each city or the change of weights of each city in which the shinkin bank operate.

Data and variables

A. The estimation of Malmquist index and choice of inputs and outputs

Data of the inputs and outputs for the estimation for Malmquist index comes from the annual income statement of the shinkin banks from FY 2005 to FY 2008. The data is obtained from the database of Nikkei NEED¹⁹.

In the estimation of productivity changes, one difficult problem is the choice of time length. To let the effects of M&A fully exposed, the paper chooses a 3 year time length.

Another difficult problem encountered is the merging, acquisition (M&A) and closing down of the DMUs. As mentioned in the

¹⁹ This database is offered by the Company “Japanese Economic News” (Nihon keizai Shimbon, Nikkei.)

The database includes various kinds of financial and economic data. FY 2001 and FY 2008 are the beginning and end year of the database when the paper is written.

introduction, to avoid this problem, I delete all of those banks which have been involved in the M&A activities or have been closed down during the period of comparison. After doing so, the number of samples for the period of FY 2005 to FY 2008 is reduced from 303 to 261.

One of the serious problems of the DEA analysis is that it is very sensitive to outliers. Here I use an approach suggested by Wilson (1993) to detect and delete the outliers from our samples.. This method is specially designed for non-parametric frontier models²⁰. By using this technique, 5 outliers have been detected in the period of FY 2005 to FY 2008 and the number of sample is further reduced from 261 to 256.

For the choice of output and input, the method used in this research is similar to the production approach. As in Horie (2010), the paper uses value rather than the volume of output and input as the measure of scales. Since the scope of business of shinkin banks is not as wide as that of large financial institutions in Japan, I focus on the credit services provided by shinkin banks, which accounts for more than 70% of the current incomes of most shinkin banks. In the income statement of shinkin banks, the credit activities are reflected under the entry of “Income on funds managed”. I group items under this entry of income into two products: A single item in the entry called “Interests from loans”, which is the interest incomes from loans, forms the first product. It is the largest source of the interest income of shinkin banks. Meanwhile, other items in the entry, such as interest incomes from call loans, bonds and deposits in other financial institutions, are aggregated to form the

second product called “other interest income.”

The paper uses net income rather than total (raw) income as output. That is, we deduct expenses on raising funds for a given credit from income gained from such credit. In this way, we not only reduce one input in the model but also avoid the difficult problem of treating deposits in the model, which is a major difference between different approaches. Interest earned from deposits is treated as income, whereas interest paid to depositors is treated as expenses incurred in the production of credit products

Unfortunately, there are no separate entries of expenses for each of the two products. All expenses are aggregated under a single entry “Fund Raising Expenses”. To get the corresponding expense for each of the two products, following Horie (2010), I divide this single entry into two entries by the weight of each product on the total interest incomes; thus the equations for the two products are as follows

$$NY_L = Y_L - \frac{Y_L}{Y_I} C_I \quad (7)$$

$$NY_{NL} = Y_{NL} - \frac{Y_{NL}}{Y_I} C_I \quad (8)$$

where:

NY_L = net interest from loans;

NY_{NL} = net other interest income;

Y_L = total interest income from loans;

Y_{NL} = total other interest income;

$Y_I = Y_L + Y_{NL}$ = total interest income; and

C_I = total fund raising expenses.

²⁰ The technique details of the method are not given in the paper due to the limitation of space, interested authors can refer to the paper by Wilson (1993).

In the input side, also two inputs are selected: One is the labor expenses. In the income statement of shinkin banks, these expenses are recorded under the entry “Labor expenses”; however, this entry only includes the expenses on the formal employees. In recent years, like in other Japanese corporations, informal workers have accounted for an increasingly large proportion of the employees in the shinkin banks. Expenses on these employees are included in the entry called “General expenses”. Due to the lack of information, it is impossible to segregate expenses on informal employees from general expenses and add them to labor expenses. Thus we should keep in mind that labor expenses do not include all of the cost of labor inputs for shinkin banks.

Another input used in this research is fixed expenses, which roughly correspond to capital input for shinkin banks. This input is the combination of two expense entries in the income statement of the shinkin banks: “General expenses” and “expenses on service transactions”. General expenses include rents for stores, depreciation, expenses on advertisements, deposit insurance fees, outsourcing expenses, and expense on informal employees, among others. Expenses on service transactions include expenses on financial services by the shinkin banks for their financial activities. This entry is neither large enough to be considered as a separate input nor too small to be ignored. Since these expenses are similar to some of the general expenses (e.g., outsourcing expenses and expenses on informal employees), I added them to general expenses.

The calculations involve data across time, making the inflation effect a necessary concern. To eliminate this effect, the paper uses the GDP deflator to deflate the data

with the beginning year of the sample period as 100.

Table 1 summarized the descriptive statistics of the inputs and outputs used in this paper:

Table I, Descriptive statistics of inputs and outputs

From table 1, it is easy to see that the scale of business of the sample banks significantly increased during the sample period, however, the variance of scale among the banks also enlarged.

B. Explanatory variables in the second stage model

All of the data about the internal variables come from the Nikki database and the yearbooks “The Japan financial directory” published also by Nikki. The descriptive statistics of internal variables are summarized in table 2:

Table II Descriptive statistics of the growth rate of internal variables

The data about the market share are obtained from the yearbooks “The Japan financial directory”. Other external data come from the “Regional Statistics Database” offered in the official website of the statistics of the Japan (www.e-stat.go.jp). Unfortunately not every year of the data for some external variables is available. Thus the end year for the variable *insti* is 2009. The end year for *pdensity* and *old* are 2010 respectively. Table 3 shows the descriptive statistics of the external variables.

Table III Descriptive statistics of the growth rate of the external variables

Because the external variables are weighted averages of the “shi”s which shinkin banks operate, their growth rates reveal both the changes of the variables and the geographical structure of the shinkin banks.

The results and their explanation

A. The results for the Malmquist index estimation

We use a package of the software R called FEAR to estimate the Malmquist index. It was designed by P. W. Wilson (2008) particularly for the purposes of DEA. The descriptive statistics of the estimation of Malmquist index and its three components for the period of FY 2005 - FY 2008 are outlined in table 4.

Table III Descriptive Statistics of the Malmquist results

For the case of hyperbolic-oriented distance measurement, higher score of Malmquist index and its components means lower growth. It is easy to find that in the sample period productivity has significantly decreased. The means and medians of the Malmquist index and two of its three components are all above 1. However, the scale economy has significantly improved during the period. The results confirm the impression we got from the descriptive statistics of the internal environmental variables in table 2.

B. The results of the second stage model and their explanation

The results of the second stage model are summarized in table 5.

Table V Estimation results of the second stage model

All of the models have low adjusted R^2 . The models of Fried et al.(1999) , Ralson et al. (2001) and Horie (2010) also have this problem. Nevertheless some interesting conclusions can still be drawn.

We first check the four time dummies for M&A. From table 5 we see that they are all insignificant for the Malmquist index. However, when we look at the components, we see a different picture. For the technical efficiency, *date04* is significant (at 5% level). *date03* is weakly significant (at 10%

level) only in the bootstrapping results. In the equation for scale efficiency, *date04* is highly significant (at 1% level). In the cases that the coefficients are significant, for LnT, the signs are negative, indicating M&A incidences in the year of FY 2001-FY 2004 have positive effects on the technical efficiency. This is in line with the market power hypothesis. However, for LnS, the signs are positive. This may indicate that many banks formed after M&A are oversized. The coefficient of *date04* is also much more significant in all equations. In the deduced results for LnE, the four time dummies are all insignificant. This tells that the M&A incidences have no significant effect on the changes of pure efficiency. The controversial effects of M&A incidences on LnT and LnS plus its insignificant effects on LnE may be the major reason why time dummies are all insignificant in the equation for LnM. As for the dynamics of the effects, the latest M&A cases have the most significant effects on these components.

The paper then checks other variables which may be related with the M&A activities. First of all, M&A activities will increase bank scale. For the Malmquist index, the variable “*dlnasset*” (change of bank income) is only weakly significant both in the original and bootstrapping results (all at 10% level). However, it is highly significant in the equations for technical and scale efficiency (all at 1% level). It is insignificant in the deduced results for pure efficiency. In case of the total score and scale economy, the signs of the coefficients are negative. This indicates that most shinkin banks are in the position of increasing returns of scale and the increasing of scale has positive effects on their productivity changes and scale economy. On the other hand, in the equation for the technical efficiency, the sign of the coefficient is positive, which means bank

scale has negative effects on technical efficiency changes, which support the hypothesis that large banks lack the motive for technical progress. Combined with insignificance of the LnE, it is not surprising the variable is less significant in the equation for Malmquist index than in the equations for the two components. The results are consistent with the findings of Al-Sharkas et al. (2008) and Hahn (2007).

As mentioned in the introduction, M&A may also cause the reduction of overcapacity and redundant labors. Thus they may bring out administration structure changes. For the three indices of administration efficiency, only $d\ln NH$ (number of department in headquarter/ number of branches) is weakly significant (at 10% level) in the equation for $\ln M$, both in the original estimation and the bootstrapping results. Some variables are so insignificant in some equations that they are omitted from the corresponding equations.

M&A also may strengthen the market power of the acquiring or merging banks. The sign of the variable $d\ln share$ (market power of the shinkin banks) is positive in the equation for the total score, scale economy and the reduced results for the pure efficiency. This supports the hypothesis that market concentration has negative effects on the change of total productivity, pure efficiency and scale economy. On the other hand, in the equation for technical efficiency changes, its sign is negative, which is against the hypothesis the banks with market power are reluctant in adopting new technologies. However, they are all insignificant, whether according to the original estimation or the bootstrapping results. This means the change of market share has no significant effects on the productivity changes and its components. Though it is not our purpose, it is also interesting to check the results for other variables. For internal factors, the variable

“ $d\ln l$ ” (Loan loss provisions ratio) is only weakly significant (at 10% level) in the equation for $d\ln M$. Its sign is positive. This means loan loss provisions have negative effects on the productivity changes. The variable “ $d\ln CAR$ ” (change of capital adequacy ratio) are significant for the Malmquist index and pure efficiency. In the equations which it is significant, its sign is negative, indicating that change of CAR ratio has positive effects on the productivity changes and pure efficiency. This support the hypothesis that high capital position makes shinkin banks take riskier but also more profitable strategies. The variable “ $d\ln npl$ ” (change of NPL ratio) is significant only for the scale economy. Its sign is positive, indicating that increase of NPL ratio has negative effects for the change of scale economy. This is easy to understand, since banks with high npl ratio are constraint in their ability to increase their assets and exploit the economy of scale.

The paper next checks the effects of external variables on productivity changes. The variable $d\ln y$ (the change of taxable income) is only significant for the Malmquist index. In all equations, its signs are negative. This supports the hypothesis that shinkin banks which located in an area with higher economic growth rate will have higher growth rate of productivity and technical efficiency.

For the indicators of economic activities, the variable $d\ln insti_i$ (the change of the number of enterprises) is only significant for $\ln S$ (only for original results). $d\ln manu_i$ (change of value of manufactures) are significant in varied degrees for the equations of $\ln M$, $\ln S$ and $\ln E$. But in some equations the signs of the variables are not what we expected.

For the two indicators about the population, the variable $dlnpop$ (change of the population density) is significant only for LnS. However, in that equation its sign is positive. This means the growth rate of population density has negative effects on the growth of the scale economy. This is not what we assumed. The variable $dlnold$ (the change of proportion of aged families) is insignificant for all the equations. In all equations its sign is negative. This means shinkin banks in the area with high growth rate of aging population have high rate of productivity growth. Again this is not what we assumed. However, some other researchers (Dietsch and Lozano-Vivas, 2008) also got the same contradictory results for efficiency analysis.

Conclusions

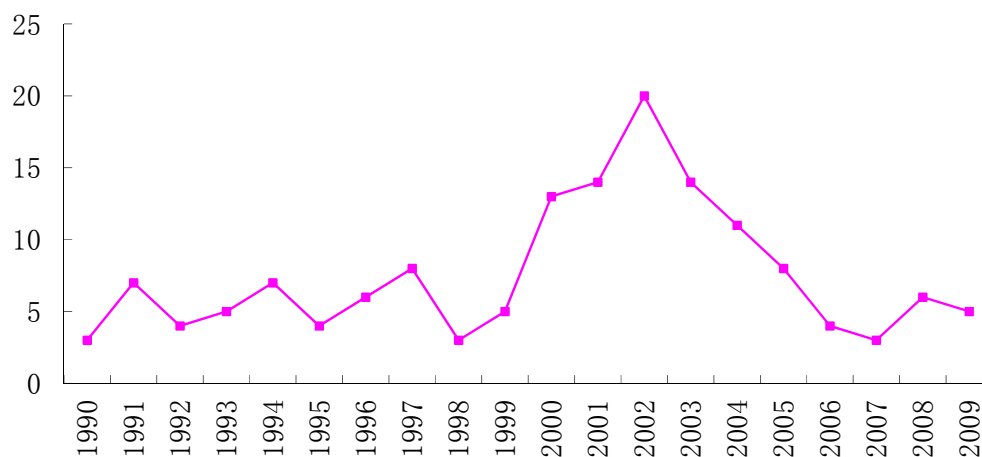
This paper at first estimates the productivity changes of shinkin banks in Japan during the period of FY 2005-FY 2008 and then investigates the effects of M&A activities on these changes. The paper finds that on average the productivities of shinkin banks

have significantly decreased. Their pure and technical efficiencies also decreased. However, their economies of scale have significantly increased. It finds that merger incidents have significant effects only on the growth of the two components (technical and scale efficiency). It also discovers that the merger incidents occurred in FY 2004 have stronger effects on these two components. This may be because it is closest to the examined period.

Some other factors which are closely related to the M&A also have significant effects on the productivity change and its components. The indicator of change of bank scale is significant for all the three equations. The indicator of change of market share is significant for two of the three equations.

All these results prove that the M&A activities occurred during the early years of 2000s have significant effects on the productivity changes and its components in shinkin banks. Thus they may offer some support for the policies of encouraging M&A activities.

Figure 1: number of M&A cases among shinkin banks in 2000s



Sources of data: Annual reports of shinkin banks by Central shinkin banks

Table I Descriptive statistics of inputs and outputs

	Unit: million yen							
	y11	y12	x11	x12	y21	y22	x21	x22
Min.	397	63	354	202	287	136	303	212
1st Qu.	1531	422.5	966.5	698.2	1372	519.5	1014	710.2
Median	2902	998.5	1807	1314	2528	1079	1827	1297
Mean	4808	1475	2873	2161	4318	1666	2835	2178
3rd Qu.	5660	1898	3434	2676	5088	2217	3359	2618
Max.	31510	11880	18280	14030	26390	11050	17980	14220
sd	5478	1589	3001	2401	4936	1723	2948	2457

Note:

y11=Net interest from loans in FY 2005 y21=Net interest from loans in FY 2008

y12= Net other interest income in FY 2005 y22= Net other interest income in FY 2008

x11= Labor expenses in FY 2005 x21= General expenses in FY 2008

x12= Labor expenses in FY 2005 x22= General expenses in FY 2008

Min, Median, Mean, Max and SD are the minimum, median, mean, max, and standard deviation of the sample, respectively.

Table II Descriptive statistics of the growth rate of internal variables

	Unit: %						
	LH	LB	NH	Asset	lp	CAR	npl
Min.	-35.110	-40.260	-100.000	-9.457	-78.800	-59.750	-70.670
1st Qu.	-7.360	-7.536	-1.161	1.202	-30.800	-3.762	-36.970
Median	1.391	-1.925	4.555	3.832	-8.363	6.567	-24.310
Mean	5.899	-1.015	8.622	4.441	4.951	5.355	-19.360
3rd Qu.	13.110	4.235	17.040	7.801	21.050	16.730	-11.060
Max.	253.300	127.800	160.000	23.180	617.500	58.070	116.500
sd	25.783	12.719	29.218	5.408	67.440	18.043	27.219

Note: variables are defined as in section II C. Min, Median, Mean, Max and sd are defined as in table I.

Table III Descriptive statistics of the growth rate of the external variables

	Unit: %					
	share	income	institute	manu	pop	old
Min.	-70.00	-56.09	-57.24	-28.70	-87.21	-38.16
1st Qu.	-4.58	1.83	-1.39	0.59	-3.68	9.53
Median	0.00	5.04	1.08	10.18	-0.83	12.89
Mean	0.15	7.27	12.70	13.36	0.49	14.19
3rd Qu.	3.20	8.91	4.10	19.52	2.04	15.52
Max.	125.30	388.30	2177.00	387.30	309.60	199.00
var	14.69	27.58	138.36	30.30	23.55	17.23

Table IV Descriptive Statistics of the Malmquist results

	malm	pure	tech	scale
Min.	0.9509	0.9066	0.9867	0.8937
1st Qu.	1.001	0.9783	1.021	0.9758
Median	1.034	1.001	1.038	0.9939
Mean	1.035	1.01	1.037	0.9896
3rd Qu.	1.06	1.04	1.051	1.001
Max.	1.217	1.206	1.09	1.068
sd	0.046	0.048	0.02	0.046

Note:

malm = malmquist index; pure= pure efficiency score;
tech= technical efficiency score scale = scale economy score

Table V Estimation results of the second stage model

	LnM		LnT		LnS	
	Original	Boot	Original	boot	Original	boot
(Intercept)	0.03116 (0.00615) ***	0.00377 (0.00569)***	0.03359 (0.00204)***	0.03361 (0.00197)***	0.00141 (0.00373)	0.0013 (0.00366)
dlnasset	-0.09079 (0.05320)*	-0.19115 (0.05139)*	0.06126 (0.02315)***	0.06126 (0.02217)***	-0.14101 (0.03077)***	-0.1383 (0.03030)***
dlnlp	-0.0074 (0.00786)	-0.01514 (0.00763)	0.00564 (0.00336)*	0.00561 (0.00331)*	-0.00458 (0.00454)	-0.00463 (0.00415)
dlnCAR	-0.03787 (0.01550)**	-0.0379 (0.01520)***			0.01432 (0.00895)	0.01378 (0.00848)
dlnnpl	-0.00821 (0.01208)	-0.00724 (0.01162)	-0.00556 (0.00533)	-0.00567 (0.00515)	0.02416 (0.00699)***	0.02418 (0.00661)***
dlnLH	0.00975 (0.01431)	0.00983 -0.01374	-0.00759 (0.00632)	-0.00778 (0.00609)	0.01161 (0.00822)	0.01144 (0.00806)
dlnLB			-0.00947 (0.01063)	-0.00948 (0.01007)	-0.01342 (0.01384)	-0.01312 (0.01353)
dlnNH	-0.01411 (0.00848)*	-0.01735 (0.00791)*	-0.00388 (0.00376)	-0.00397 (0.00367)		
date01	-0.01543 (0.01332)	-0.01438 (0.01310)	-0.00912 (0.00589)	-0.00912 (0.00572)	0.01039 (0.00770)	0.01043 (0.00725)
date02	0.01067 (0.00897)	0.01917 (0.00849)	0.00192 (0.00394)	0.00192 (0.00387)	-0.00086 (0.00518)	-0.00078 (0.00489)
date03	-0.00014 (0.01140)	0.01379 (0.01097)	-0.00811 (0.00502)	-0.00784 (0.00472)*	-0.00089 (0.00659)	-0.00077 (0.00640)
date04	-0.01109 (0.01684)	-0.0149 (0.01645)	-0.01639 (0.00739)**	-0.01609 (0.00730)**	0.03002 (0.00974)***	0.02988 (0.00949)***

dlnshare	0.03428 (0.02327)	0.03697 (0.02293)	-0.00939 (0.01019)	-0.009 (0.00987)	0.01941 (0.01353)	0.01936 (0.01303)
dlny	-0.00966 (0.01122)**	-0.01931 (0.01090)	-0.00415 (0.00486)	-0.00415 (0.00462)	-0.00776 (0.00657)	-0.0077 (0.00602)
dlninsti			0.00684 (0.00493)	0.00697 (0.00466)	-0.01264 (0.00769)*	-0.00631 (0.00911)
dlnmanu	0.03326 (0.01586)	0.03825 (0.01560)**			-0.0061 (0.00922)	-0.0125 (0.00754)*
Dlnpop	-0.00354 (0.01744)	0.0229 (0.01663)	-0.00979 (0.00693)	-0.00982 (0.00677)	0.01826 (0.01008)*	0.01846 (0.00950)**
Dlnold	0.01484 (0.02964)	-0.00826 (0.02703)			-0.0078 (0.02023)	-0.00793 (0.01933)

Adjusted R-squared

0.04283

0.05011

0.1326

LnE	Original	boot
(Intercept)	-0.00384 (0.00748)	-0.00379 (0.00740)
dlnasset	-0.01103 (0.06567)	-0.01389 (0.06661)
dlnlp	-0.00846 (0.00968)	-0.00857 (0.00933)
dlnCAR	-0.05219 (0.01789) ***	-0.05209 (0.01783) ***
dlnnpl	-0.02682 (0.01494) *	-0.02647 (0.01462) *
dlnLH	0.00572 (0.01767)	0.00708 (0.01796)
dlnLB	0.02289 (0.01745)	0.0226 (0.01749)
dlnNH	-0.01023 (0.00927)	-0.0108 (0.00896)
date01	-0.01669 (0.01648)	-0.01652 (0.01614)
date02	0.00961 (0.01108)	0.00943 (0.01067)
date03	0.00886 (0.01409)	0.00894 (0.01381)
date04	-0.02472 (0.02081)	-0.02389 (0.02034)
dlnshare	0.02426 (0.02878)	0.02309 (0.02823)
dlny	0.00225 (0.01388)	0.00211 (0.01336)

dlninsti	0.0058	-0.00066
	(0.00913)	(0.00989)
dlnmanu	0.03936	0.04581
	(0.01835) ***	(0.01692) ***
dlnpdensity	-0.01201	-0.01209
	(0.02130)	(0.02079)
dlnold	0.02264	0.02354
	(0.03589)	(0.03481)
Adjusted R-squared		

Note: a. ***: significant at 1% level., **: significant at 5% level. *: significant at 10 % level

b. figure in bracket is the standard error of the estimated coefficient.

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